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SOME PRESENT PROBLEMS IN AGRICULTURE.*

AGRICULTURE is now in a transitional stage. It is passing from the old to the new. It is pupating. The problems are great, and they all have a forward look.

Most of these problems are incapable of solution quickly. They must ripen and mature. They are many; this paper proposes to indicate only a few of them that appeal most to me.

The problems of agriculture are of pressing importance, both to agriculture itself and to the public welfare. They are of two kinds: (1) the technical problems of the business, (2) the problems of adjustment to the affairs of our growing civilization.

The problems of adjustment are of the greatest public concern, because agriculture is our greatest occupation. Agriculture is necessary to civilization. Of all occupations, it employs most men, most capital and is followed in the most places. It probably must always employ from one fifth to one fourth of the people of any self-sustaining nation. There are super-

* Paper read by L. H. Bailey before Department 18, Section on Agriculture, of the International Congress of Arts and Science, St. Louis, September 24, 1904.

numerary, eleemosynary and parasitic occupations; but agriculture is basic.

Other occupations have had their day in the public appreciation. All of them have been born out of agriculture. Tubal-Cain was the descendant of Adam. The greatest of public problems are to come with the rise of the agricultural peoples. Just because it is basic, agriculture has been conservative and patient. Fundamental strata are likely to be azoic; but in great world-movements they are also likely to rise permanently to the top.

The farmer is a wealth-producer. Therefore, his importance in the body politic is primary. He deals with elemental forces. As a wealth-producer, he will come to have a larger voice in the expenditure and waste of wealth in maintaining armaments of war. All his instincts are of peace.

The public problems of agriculture have been slow to gain recognition. The agricultural questions that we customarily discuss are those of the individual farmer. The burden of our teaching has been that the farmer must be a better farmer. Only in recent years has it come to be fully recognized that agricultural problems are of the greatest national and governmental significance. Consider how recent is the Land Grant Act, the secretaryship of agriculture in the President's cabinet, the experiment station act, the origin of a definite farmers' institute movement, the development at public expense of fertilizer and feed controls and other policing policies, the making of liberal grants of public money for specific agricultural uses.

Governmental fiscal policies have been shaped primarily for other occupations, as, for example, the tariff for protection. This is primarily a manufacturer's policy. It matured with the rise of concentrated manufacturing. One of the stock arguments of the protectionist when addressing farmers is that any policy that aids manufacturing interest must indirectly aid them. I am not here to discuss or to criticize tariff legislation, but it is apparent that such legislation is only secondarily of benefit to agriculture. It has been the history of institutions that special and organized interests receive attention before care is given to the common people and the masses.

We have really not endeavored, as a people, to solve our technical agricultural problems until within the present generation. We have escaped the problems by moving on to the west. Thereby we have fallen into the habit of treating symptoms rather than causes, as the policeman does when he orders the offender to 'move on,' and leaves the real difficulty for some one else to solve. Even yet, farmers are moving on to find land that is not depleted and regions free of blights and of pests. The real development of agriculture lies in developing the old areas, not in discovering new ones. When virgin land can no longer be had, scientific agriculture will be born. An isolated island develops something like a perfected agriculture, as one may see in Bermuda or Jersey. The earth is an island: in time it will be developed.

As agriculture comprises a multitude of different businesses, everywhere touching many sciences and having contact with many public questions, so it is impossible for one person adequately to state even its present and pressing questions. I have been in the habit of inquiring of farmers, students and colleagues what they consider the agricultural problems to be. Many of the problems that they have stated to me are temporary, local or incidental. Others are common to many occupations, having to do with the general constitution of society and the general trend of economic events. In this paper I have tried to assemble statements of such questions as appear to me best to illustrate the complex nature of the subject before us. I wish I

could give credit to the sources of all the suggestions, but this is impracticable, even though in some cases I have followed very closely the ideas and the language of my informants. I shall be obliged to assume full responsibility for the statements.

THE TECHNICAL AGRICULTURAL PROBLEMS.

In America the so-called problems of agriculture have been largely those of the mere conquest of land. They are the result of migration and of the phenomenal development of sister industries. They have resulted from a growing, developing country. They have been largely physical, mechanical, transportational, extraneous—the problems of the engineer and inventor rather than of the farmer. The problem has not been to make two blades of grass grow where only one grew before, but how economically to harvest and transport the one blade that has grown almost without effort.

During the past hundred years there has been an area of development on the western border of the developed country, and this has been able to compete at an economical advantage with the older area farther east. The price of land has fallen in the east, while it has risen in the west. From 1870 to 1900 we practically doubled our population and doubled our agricultural area. Aside from the geometrical increase in the population, this development has been due to a fertile, level prairie which was practically treeless. Hitherto the axman has hewn his way tree by tree. The development of the area west of the Mississippi River is probably the most remarkable in the history of the world. A second cause for this development is the consolidation of railroads into transcontinental lines; and another is the improvement of labor-saving machinery, of which the self-binding harvester is the most conspicuous example, a machine that first attracted wide attention at the Centennial Exposition in 1876.

To this day the American is a cheap-land farmer. A few minutes on the train from a European city brings one into a highly tilled agricultural country. The other day I took an express train from New York city. It was three quarters of an hour before I saw what I could call a farm, and a full hour before I reached a farming country.

As early as one hundred years ago, a distinct movement for the betterment of agriculture had set in. This movement was largely educational. It was an effort to improve the farmer, quite as much as to improve the farm. Washington was vitally interested in the problem. He wished to have a central board or clearing-house for agricultural information. The full fruition of his hopes came with the establishment of a secretaryship of agriculture in the President's cabinet, in Benjamin Harrison's administration. In 1799 a concrete proposition for the establishment of an agricultural college in Pennsylvania came to an untimely end. In 1821 instruction was given in agriculture in the lyceum at Gardiner, Maine. In 1824 a school of agriculture was opened at Derby, Connecticut. A number of other similar attempts were made previous to the passage of the Land Grant Act of 1862, but of these only the Michigan Agricultural College persists. The gist of the whole movement was to adapt education to men's lives. The culmination was the Land Grant Act, the purpose of which is 'to promote the liberal and practical education of the industrial classes in the several pursuits and professions in life.' So far as agriculture was concerned, the Land Grant Act was somewhat premature. The developing and organizing mechanical and engineering trades were the first to profit by it. Agriculture will now have its turn.

The tide to the limitless west rose and fell, and we came to a pause. The technical problems of the farmer called for solution. His personal difficulties pressed for solution directly on the farm. These problems are of two categories: (1) to remove the special disabilities (insects, fungi, weeds, animal diseases), (2) to augment production (fertilizers, soil studies, tillage, improving plants and animals). Then was born the experiment station (in 1887): the idea is to improve the farm; it is investigational, not educational.

How special the purpose of the experiment station act is, may be seen at once from the purposes that it definitely mentions:

> That it shall be the object and duty of said experiment stations to conduct original researches or verify experiments on the physiology of plants and animals; the diseases to which they are severally subject, with the remedies for the same; the chemical composition of useful plants at their different stages of growth; the comparative advantages of rotative cropping as pursued under a varying series of crops; the capacity of new plants or trees for acclimation; the analysis of soils and water; the chemical composition of manures, natural or artificial, with experiments designed to test their comparative effects on crops of different kinds; the adaptation and value of grasses and forage plants; the composition and digestibility of the different kinds of food for domestic animals; the scientific and economic questions involved in the production of butter and cheese; and such other researches or experiments bearing directly on the agricultural industry of the United States as may in each case be deemed advisable, having due regard to the varying conditions and needs of the respective states or territories.

The experiment stations are holding to these special fields with great faithfulness. In a lot of three hundred and fourteen bulletins that came to my attention bearing the date of 1903, the following rough classification of subjects was made:

Bulletins, 1903.

Insects, diseases of plants	63 or 20%
Feeding and grazing	52
Fertilizers	37
Farm crops	33
Fruits, orchards	28
Dairy (milk and cheese)	23
Diseases of animals	16
Meteorology	15
Garden vegetables	12
Sugar	7
Natural resources, irrigation	7
Poultry	4
Weeds	4
Ornamental plants	4
Seed germination	3
Educational	3
Forestry	2
General advice, bees exhibitions, plant-breeding, etc	1
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Some epochs are now passing—as the fertilizer epoch based on agricultural chemistry. The larger question of self-sustaining farm management is now pressing. Three categories of technical farm subjects are just now beginning to demand much thought: (1) problems of feeding to increase efficiency of farm animals; (2) problems of breeding of animals and plants for the same purpose; (3) problems of the business organization of the farm, or the development of a farm-plan. We are beginning to apply research to large fundamental questions. The earlier subjects of investigation in the agricultural experiment stations were mostly the smaller and incidental ones. Now the fundamental or backbone crops and products are being investigated in their entirety—the corn crop, the cotton crop, the grass crop, the milk product, the beef product. The experiment stations are originating a kind of constructive investigational method, and the really great questions are ahead of us. Large problems come last.

We are now just coming to the large question of adaptation of special areas to

special purposes. In the future one of the problems will be the more perfect adaptation of the kind of farm to soil and climate. As an illustration, the production of domestic animals for meat and for wool has been most extensive on the western border of the developing country for economic reasons, and not because the area is naturally best adapted to this enterprise. The Mississippi valley is primarily adapted to the production of cereals and not nearly as well adapted as the north Atlantic states to the production of grass either as pasture or hay. These Atlantic states are particularly adapted to growing all kinds of trees and of grass. In the course of time, therefore, we may expect that the production of live stock will become more important in the east. Out of this grow some immediate problems. At present, live-stock husbandry in the east can be carried on economically only when large tracts of land can be purchased at low price. It is possible to purchase small tracts of land at comparatively low price, but not possible to purchase large areas. More of the live stock will be raised upon small farms within the more densely populated districts, with comparatively few animals to a place. This will lead to the question of maintaining the improvement in domestic animals. It will mean the gradual substitution of soiling systems for pasturing systems, and this will lead to remoter economic and social changes.

New industries are to be developed. This calls for special governmental recognition. The national Department of Agriculture aids such new enterprises by giving counsel and investigating the special technical difficulties; but is this kind of aid sufficient? If the government helps new manufacturing industries by giving them special privileges, why not aid new agricultural industries by bounties? If a bounty system were to become a recognized public policy (following perhaps the experience with sugar bounties), would it result in undesirable social and economic changes? The money grants to agriculture are only a fair offset to special privileges given to other industries.

THE SOCIAL AND ECONOMIC PROBLEMS.

We are now returning to the farmer, although still holding to the farm. There is a distinct recrudescence of the educational point of view. The new emphasis is to be placed on the man rather than on his crops. The farmer is a citizen as well as a farmer; he is an important factor in public affairs.

The new education must reach the farmer in terms of the whole man—his particular business, his home and its ideals, his relation to good roads, good schools, the church, to social forces, to all that makes up a broad and satisfying country life. We must give attention to the ideals of living, as well as to the ideals of farming. The sanitation of the farm home, the architecture of the buildings (what silent and effective teachers buildings are!), the reading, the character of the farmyard, the questions associated with the bringing up of children, the social and commercial organizations—these are the kinds of subjects that the rising educational impulse must attack.

All this enforces the economic and social questions relating to agriculture. The greatest problems of American agriculture are not the narrower technical ones, but the relations of the industry to economic and social life in general. Agriculture has not as yet been able to call to its aid in any marked degree those forces and tendencies which have culminated and been of such economic value in the general business world, in the great productive and distributive aggregations. The complete solution of the economic ills of American agriculture may not be in cooperation, and yet in both the productive and distributive phases

this is perhaps the most apparent remedy. Cooperation in distribution has made a beginning, but cooperation in production is still almost unknown. Are Kropotkin's ideals attainable?

The problem of the supply of capital in agriculture has never been solved in this country other than in the most expensive way. Capital must return to the land. Two factors enter into the problem: (1) to demonstrate that capital can be made remunerative in farmed land, (2) to insure that land will not bear an unjust burden of taxation.

Closely associated with the economic side is the sociological phase. In the days when all were interested in agriculture, both school and church flourished, but in these later days both have lost their molding influence in the country, though the former shows signs of renewed activity vital to the community.

The specific economic and social questions that even now press for study are so numerous that they can not be catalogued in an address of this character. Is there still an active exodus from the country? If so, is the movement caused by purely economic conditions, or is it in part the attractiveness of the city? In other words, does the education of the farmer fit him for the appreciation of the esthetical and philosophical value of his environment? In what relations do the labor-saving devices stand to the rural exodus? Can it in any way be due to super-population of the rural communities? Are the rewards of labor greater in the city than in the country? Is the arrested development of country church and school in any way responsible?

What are the tendencies as to size of farms? Is the American, starting with small individual ownership, tending towards consolidation into larger units? Is the European, starting with large landlorded ownership, tending towards small individual units? Are the small farms decreasing in number? In what way does the development of the railroads and electric roads affect the size of farm properties? In what way do the labor-saving devices influence the size of farms? Could cooperation of farmers remedy any tendency towards large farms? Or, are larger farm units to be desired?

What can cooperation do for the farmer? Must it be economic, social, political, or to increase production? What are the moral and psychological effects of cooperation? What relation can cooperation have to the isolation of the farmer? To his hygienic conditions? Is it possible by means of cooperation to save small individual ownership of farms?

Is it true that the country promotes health better than the city? What are the diseases of the country? Are there mental diseases of isolation? Are most of the farmer's diseases due to his work, environment or poor intellectual preparation to meet the requirements of his condition? What could the state do for the farmer from a hygienic standpoint? What are the relations of farm water supplies to the prevalence of typhoid fever, and other diseases?

How is isolation to be overcome? By a hamlet system? Or by a distributive system of communication—as by better roads, trolley lines, auto-vehicles, rural mail delivery, telephones, traveling libraries, cooperative reading courses? Is the social life of the small village as vital and wholesome as that of the separated farm home?

These are only the merest suggestions of a very few apparent present problems. They are not to be solved by any *a priori* reasoning, nor by using the stock statistics and opinions of economists and sociologists. The field must be newly studied. New data must be collected. New means of attack must be developed. With much

painstaking, actual facts in detail must be secured. What is the actual social and economic status of every farmer in a township? a county? a state? Who knows? History must be studied from a new point of view. The very foundation of historical development is public opinion of the common people; and until within the past century the common man was the farmer. Agriculture is the basis of history. The best data of the actual conditions of the people antecedent to the French Revolution are found in Arthur Young's minute description of the agriculture of France. The historian of agriculture is yet unborn.

As an example of the inadequacy of our information on important economic problems, let me cite the most pressing problem just now confronting the American farmer —the question of farm labor. Farm labor is scarce; it is dear; it is inefficient; it is unreliable. Yet we read of the armies of the unemployed, asking for bread. Why? Who can answer? Who has the data? There seems to be not one authority to whom we can turn. It is apparent that these serious pressing problems—scarcity, expensiveness, inefficiency of farm labor—are only symptoms of some deep-seated mal-adjustment.

A large proportion of the labor on farms is done by the farmer himself or his growing family. The inability to find steady employment for laborers is a very difficult problem. Ordinarily, men desire to work all the time and to use their energy to the best advantage. A farmer's family arrives at the productive age when the parent is between forty-five and sixty. The farm does not offer opportunity for the sons because the father still desires to maintain his activity. The farmer does not take the boy into his business to the same extent that other business men do. The result is that the sons must find employment elsewhere, and in the nature of the case can most conveniently find employment on salary. By the time the father is sixty-five to seventy years of age and feels the necessity of giving up the farm, the sons are engaged in other lines of effort which it is not practicable for them to leave. The result is that the farm declines with the declining years of the father and upon his death is sold or becomes a rented farm. Occasionally a parent solves the difficulty; and herein a distinct public responsibility rests on the individual farmer.

Is the farm labor difficulty a too low wage-rate? Is farm labor inefficient merely because it is cheap? If so, how must the farm be made to be able to pay a rate in competition with other labor? Has the tariff contributed to the inequality? Is social poverty of the country districts a cause? Is the lack of continuity, or unsteadiness, of farm labor responsible? Has the decrease in the size of the farmer's family been responsible for part of the trouble? And if so, why has his family decreased? Must the farmer of the future raise his own labor? Must machinery still further come to his aid? If so, what effect will this have on systems of agriculture? Will the urbanization of the country tend to establish a regularity of farm labor? Will cheap railway rates from cities for laborers aid in maintaining the supply of labor for those living on the land, making it possible for them to find work during winter in some neighboring community (it has helped in some parts of Europe)? Can we develop a competent share-working system, in which the owner of the land still retains directive control? And if so, will social stratification result? Must there come a profit-sharing system? Or must the greater number of farmers themselves become employees of men of great executive ability who will amalgamate and syndicate agricultural industries as they have amalgamated other industries? Is the agricul-

ture of the future to be a business of fewer and larger economic units? If so, how will this affect the centers of population and the social fabric? Will the lack of farm labor force us more and more into 'nature farming'—the hay and pasturage systems? What is the farm labor problem?

The country as well as the city must be made attractive and habitable. It must express and satisfy the highest human ideals, else it will not attract the best men and women. In area and in population, the country is the larger part of the national domain; the improving of the ideals of the persons that live therein is one of our greatest public questions. The farmer is the conservative, not the dynamic, element of society. We live in a dynamic social age.

The farmer always will be relatively conservative. His business is rooted in the earth. In a thoroughly well developed agriculture, the farmer does not move his business rapidly from place to place. He remains, while others move on. Therefore, it is especially necessary that we extend to him all the essential benefits of our civilization. (I hope he will not care for the unessential benefits.) He has the rural free delivery of mails—although this was thought to be impossible a few years ago. Shall he not have a parcels post? Each year the good roads movement, originating at the cities, is extending itself farther into the real country. Trolley lines are extending countryward; soon they will come actually to serve the farmer's needs. The telephone, as a separate rural enterprise, is extending itself. Extensional educational enterprises are reaching farther and farther into the open farming districts. Cooperation and organization movements are at the same time extending and concreting themselves.

Farming stands for individualism as distinguished from collectivism. Farming enterprises will be more and more amalgamated and capitalized, but they can never be syndicated and monopolized to the same extent as many other enterprises. How best to preserve and direct this democratic individualism of the open country is one of the greatest questions now confronting us.

The art impulse will soon take hold of the country, as it has already laid hold on the city. We have lived all these centuries on the assumption that work of art is associated with buildings and 'collections.' As nature is the source of all our art, so the time is coming when we shall allow nature herself to express her full beauty and power. We shall go to nature oftener than to art galleries. We shall first remove objectionable features from the landscape—features for which man is responsible—such as all untidiness and blemishes, all advertizing signs, all unharmonious buildings. Then we shall begin to work out our enlarging aspirations with the natural material before us—make pictures with sward and trees and streams and hills, write our ideals in the sweep of the landscape and the color of the flowers. Our 'art' societies still confine themselves to imitation art. The great art societies will be those that give first attention to nature as it is, not merely as it its represented to be in plastic materials and in paints.

Of all the forces that shall revitalize and recrystallize the country, the school is the chief. The schools make the opinions of the nation. The city school has been developed, but the country school has been relatively stationary; yet every farm family is interested in the school. The farmer believes in schooling, just as completely as the city man does; but he may not be convinced that the schools are really touching the problems of life. Persons make more sacrifices for their children than for any other cause. Probably more

persons leave the farm to educate their children than for all other causes combined.

An ideal condition would be the total abolition of rural schools as such. The custom of setting apart towns and villages into special school districts in order separately to tax the town or village for school purposes has been a misfortune to the rural schools. The whole school system of any state should be organized on a broad enough basis so that every boy and girl, whatever the occupation of the parents, has the opportunity of securing the same, or at least equally efficient, education. The country mill has gone. The old-time country school is a passing institution. A one-teacher school is as inefficient as a one-man mill. Schools will be consolidated into larger and stronger units. The first pedagogical result will be the differentiation of the work of teachers—perhaps one of these teachers can give special attention to nature-study and country-life subjects.

The school must connect with real life. It will be one of the strong constructive and dynamic influences in our social organization. At present its tendency is receptive and passive, rather than creative. The particular subjects that shall be taught are of less importance than the point of view. Many questions of detail are to be discussed, often with much travail; but the final solution must be to allow every subject in which men engage to find its proper pedagogic place in a wider and freer educational system than the world has yet seen, and to place agricultural subjects with the others and not exclusively in institutions by themselves.

Whatever our doubts and misgivings, the American farmer is bound to be educated. He will demand it. Having education and being endowed with a free chance, he will not be a peasant. Some persons have made the serious mistake of confounding peasantry with comparative poverty. Peasanthood is a social stratum. It is a surviving product of decaying social conditions.

If the open country is to be made attractive to the best minds, it must have an attractive literature. There must be a technical literature of the farm, and also a general artistic literature portraying the life and the ideals of the persons in the country. The farm literature of a generation ago was largely wooden and spiritless, or else untrue to actual rural conditions. The new literature is vital and alive. The new, however, is yet mostly special and technical, with the exception of the growing nature-literature. Artistic literature of the farm and rural affairs is yet scarcely known. Where is the high-class fiction that portrays the farmer as he is, without caricaturing him? Where is the collection of really good farm poems? Who has developed the story interest in the farm? Who has adequately pictured rural institutions? Who has carefully studied the history of the special farm literature that we already have? Who has written the biological evolution progress that attaches to every domestic animal and every cultivated plant? We need short and sharp pictures of the man at his work and the woman in her home—such quick and vivid pictures in words as an artist would throw on his canvas. There is nobility, genuineness and majesty in a man at useful work—much more than there is in a prince or a general or a society leader, whose rôle it is to pose for the multitude. The man holding the plow, digging a ditch, picking fruit, the woman sweeping or making bread—what stronger pictures of human interest can there be than these? If I could have the choice of the mite that I should contribute to the developing and the nationalizing of agricultural sentiment, I should choose its literature.

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*ALBATROSS EXPEDITION TO THE EASTERN PACIFIC.**

III.

We left the Galapagos (Wreck Bay) for Manga Reva on the tenth of January. On the northern part of this line we did but little work beyond sounding, as we were likely to duplicate our former work to the eastward. The fourth day out, in latitude 5° south, we began a series of trawl hauls, surface hauls and intermediate towings to 300 fathoms. In the northern part of the line to Manga Reva the hauls were remarkably rich as long as we remained within the influence of the western extension of the Humboldt Current, and as long as there poured from the surface masses of the radiolarians, diatoms and Globigerinæ living in the upper waters. Some of the hauls were remarkable for the number of deep-sea holothurians and siliceous sponges. Among the former I may mention a huge *Psychropotes,* 55 cm. long.

As we passed south and gradually drew out of the influence of the western current we entered the same barren region we passed through to the eastward when going to and from Easter Island. By the time we reached latitude 15° south the hauls became quite poor, and this barren bottom district extended to within a short distance of Manga Reva; and corresponding to it we found a most meager pelagic fauna, both at the surface and down to 300 fathoms—so poor that it could afford but little food to the few species, if any, living on the bottom in that region.

We arrived at Manga Reva on the twenty-seventh of January and found our collier awaiting our arrival.

While at anchor in Port Rikitea we examined Manga Reva, the principal island of the Gambier group, from its central ridge on the pass leading from Rikitea to Kirimiro on the west side of Manga Reva, as well as from the pass leading to Taku. On both these passes we obtained excellent views of the barrier reef to the west, north and east of the Gambier Islands, and we could trace in the panorama before us the western reef extending in a northeasterly direction parallel to the general trend of Manga Reva Island for a distance of about 5½ miles.

From the northern horn to nearly opposite Kirimiro Bay the barrier reef has only three small islets. It is narrow, of uniform width, about one third of a mile, plainly defined, submerged in places, and passing north bounds a large northern bight dotted with numerous interior coral patches from a quarter of a mile to a mile in diameter or length, with from 7 to 11 fathoms. The southern part of the western barrier lagoon off Manga Reva is irregularly dotted with many small patches of reef, with an occasional deep hole of from 15 to 20 fathoms near Manga Reva Island. From the islet to the west of Kirimiro there are but few coral patches, indicating a reef which dips gradually in a distance of a mile to a deep channel of from 4 to 6 fathoms, which separates the northern and western reef from the great reef flat lying to the southwest of Tara Vai. This flat has a width of nearly 2 miles, is about 4½ miles long, and is marked at its southwest extremity by a series of low islets arranged in a somewhat circular line, formed by three deep bays and spurs from the outer line of islets, as so frequently occurs on wide reef flats in atolls of the Pacific.

This part of the reef is called Tokorua. It shelves very gradually from 3½ to 4 fathoms on the west face to 7, and connects with the plateau upon which stands Tara Vai and Aga-kanitai. From Tokorua

* Extract from letter No. 3, from Alexander Agassiz to Hon. George M. Bowers, U. S. Commissioner of Fisheries, on the cruise of the Fisheries Steamer *Albatross*, in the Eastern Pacific, dated Acapulco, Mexico, February 24, 1905.

the reef extends in an indefinite narrow ridge 8 miles long, with from 3 to 8 fathoms, in a southeasterly direction. The western edge is steep to, and the eastern face passes gradually into the lagoon, which at that point has a general depth of 8 to 20 fathoms. The deepest part of this region is at the foot of Mt. Mokoto between it and Tara Vai, though Tara Vai is united with Manga Reva Island by a plateau varying in depth from 3½ to 4½ fathoms.

At the southeastern point of the reef it passes into a wide plateau with from 9 to 10 to 15 fathoms. This plateau is about 9 miles wide southwest of Tekava. That part of the atoll has not been well surveyed, so that the position of the reef flat has not been ascertained further west on that part of the east face; but the southeast passage indicates 5½, 6 and 6½ fathoms, where it probably marks the southwestern extension of the eastern barrier reef, separating the lagoon from the southern plateau to the south of the encircling reef.

The western face of Manga Reva and of Tara Vai are indented by deep bays, which are formed by spurs running from the central ridge of these islands, the remnants probably of small craters which flanked the large crater, of which Manga Reva forms the western rim and Au Kena is the remnant of the southeastern edge, the former extension of this rim being indicated by the spits uniting the base of Mt. Duff with Au Kena; and by the projection of Au Kena towards the outer barrier reef, and of the numerous patches of coral reef off the northeast point of Manga Reva towards the outer line of motus until they almost unite with the barrier reef.

The whole of the western bays of Manga Reva Island is filled with fringing reefs which leave but here and there a deeper pass to the shore. The south face at the foot of the bluff of Mt. Mokoto and Mt. Duff is edged by a flourishing fringing reef, which extends nearly half a mile on the plateau at their base. The port of Rikitea is a reef harbor formed within the large fringing reef which occupies the whole of the southern bay of Manga Reva Island. The east face of Tara Vai and part of the east and of the west face of Aga-kanitai are also fringed with reefs.

The islets and the islands of Aka Maru, Makiro and Makapu are within a fringing reef flat which runs around the west face of Aka Maru; Au Kena is also fringed by an extensive reef which runs out in a spit of more than half a mile in a northeasterly direction almost to the outer line of motus, which are nearly united with it by these irregular patches. To the west of Au Kena a huge spit of 2 miles in length extends towards the base of Mt. Duff and almost unites with the fringing reef off the Cemetery, leaving a narrow but deep pass for the entrance of ships into the inner harbor of Rikitea. There is only 1 to 2¾ fathoms of water on these two spits.

The depth of the basin within this area with from 25 to 31 fathoms would be naturally explained as being part of an ancient crater, as in Totoya in Fiji; its northeastern rim is also, perhaps, further indicated by the comparatively shallow flat of the lagoon to the west of the barrier reef, with from 5 to 11 fathoms of water.

The principal islands of the group are in the central part of the lagoon. The four larger islands are Manga Reva, Tara Vai, Au Kena and Aka Maru. Tara Vai is flanked by Aga-kanitai and another islet to the west called Topunui; Aka Maru is flanked by Mekiro to the north and by Maka-pu to the south. The southeast face of Aka Maru is an extinct crater, of which Maka-pu forms the south rim. The main ridge of Tara Vai is the edge of parts of three craters now opening to the west. The four small volcanic islands in the southern

part of the lagoon are isolated fragments, steep, greatly weathered and disintegrated. No soundings exist to show their relation to the other islands of the group.

The soundings thus far made indicate in the southern part of the lagoon a depth of about 23 fathoms, with an occasional hole of from 38 to 40, and a gradual slope towards the outer sunken reef. To the south of the old crater of Manga Reva the general depth of the bank varies from 6 to 11 fathoms, with a deeper channel varying from 20 to 40 from southwest of Au Kena towards Tara Vai. The lagoon seems to form a western basin where the depth varies from 10 to 20 fathoms. To the west of Au Kena and Aka Maru, lying between them to the line of the outer barrier reef islets, a similar but shallower and flat basin exists, off the northern end of Manga Reva, between it and the northern horn of the barrier reef, with from 7 to 11 fathoms. Its rim is formed by a ring of reef patches of varying size.

On two occasions we visited the outer barrier reef and examined the outer line of islets of the eastern face of the Gambier Islands. The position of the islets as marked on the chart is not that of to-day, and the position of the reef flats is not accurate. The position of Tekava and Tauna appears to be correct. Opposite Au Kena and in its extension, the east face of the barrier reefs projects sharply to the east, forming an angular horn with one island south of the horn and the other north, running at sharp angles with it, so as to form a triangle which makes a deep bight opening westward to such an extent that when off the northern side of the horn we could see Tekava far to the westward of it. The second island is followed by a third and then by an island (Taraururoa) nearly 2 miles long; these are separated by small gaps. Then comes a larger island (Amou) followed by three small islands separated by deep gaps.

At Vaiatekeue (not the Vaiatekeua on the chart) the reef flat becomes quite narrow; it is hardly more than 100 yards wide; the islets perhaps 50. The northern islets are small and separated by long stretches of low shingle and carry but little vegetation and very few cocoanut trees. There are but two short sand beaches all the way from the northeastern to the eastern horn of the eastern face of the encircling reef of Manga Reva. A regular dam of shingle from 10 to 14 feet high, on the top of which the usual coral reef vegetation flourishes, extends along the inner face of the reef flat, which varies from 50 to 150 yards in width, and is flanked at the base by low buttresses of modern elevated coral reef rock and of breccia, in places all more or less weather beaten and honeycombed.

The islets and their formation and their junction or division into larger or smaller islets and the gaps which separate them; the mode of formation of the buttresses, of the planed-off, hard, nearly level reef flat, of the coralline mounds of the outer edge—all these differ in no way from what has been described in other barrier reef islands and atolls of the Pacific.

The beaches of the lagoon are steep, and corals do not seem to thrive in those parts of the lagoon to which the sea does not have access or at some distance from shore. This is well shown by the vigorous growth of corals in the fringing reef to the south of Mt. Duff on the outer edges of the reef patches of Port Rikitea, and on the spits which connect Au Kena with Manga Reva, in contrast with those along the west face of the lagoon flats to the west of the eastern barrier reef.

There is a northeast horn of the eastern barrier reef in the extension of Manga Reva Island, forming the northern cul-

mination of the central bight of the eastern face of the barrier reef. From that point the reef flat runs westerly to form the northern horn about 3 miles north of Manga Reva Island. The position of the outer reef can not be correct on the chart (H. O. No. 2024). On leaving Manga Reva we made three soundings close off the reef flat line of breakers—one off Tekava, at the most one third of a mile from the reef, in 225 fathoms. Our position, plotted by tangents to the volcanic islands or by their summits, indicated in this case, on the chart, a distance of 1½ miles. A second sounding of 245 fathoms off the eastern horn at less than one half mile indicated on chart No. 2024 a distance of 2 miles from the horn; and a sounding of 241 fathoms one fourth of a mile off the point which we had visited (Vaiatekeue) indicated a distance of three fourths of a mile on the chart.

The slope of the Gambier Archipelago to the east is steep. On coming in sight of Manga Reva we sounded in 2,070 fathoms at a distance of 11 miles from Mt. Duff, that is, 6 miles from the outer edge of the reef bearing southwest; and on coming out we sounded again half-way to that point at a distance of 3¼ miles from the breakers in 1,394 fathoms.

One can not fail to be struck with the similarity of the Manga Reva Archipelago with the great atoll of Truk. If I remember rightly, Darwin also called attention to this from a study of the charts. Yet, owing to the great size of Truk, no less than 125 miles in circumference, and the great distance of the barrier reef from the encircled volcanic islands, the effect as one steams into Manga Reva is totally different from that produced by Truk. In the latter some of the islands, though large, and of the same height as those of Manga Reva, are much more scattered, and seem of comparatively small importance in the midst of the huge lagoon which surrounds them. The barrier reef islets of Truk are from 11 to 15 miles distant from the encircled volcanic islands. In Manga Reva, which is only 45 miles in circumference, after passing the small islands in the southern and open part of the lagoon when once off Maka-pu, we can fairly well take in the atoll as a whole. The western island (Tara Vai) is only 5 miles off; Manga Reva and Au Kena are about 3, as are also the islets of the east face of the barrier reef; these distances, as you approach the entrance to Rikitea, are constantly growing less, so that when in the gap between Manga Reva Island and Au Kena, at the foot of Mt. Duff, none of the larger islands is more than 3 miles off; and the islets of the eastern face of the barrier reef are seen to the northeast about 4 miles off. When on the summit of the central ridge of Manga Reva one can, in a radius of a little more than 4 miles, take in the whole panorama of Manga Reva, and get an impression of the relations of its different parts far better than can be conveyed by the chart, for the whole of the visible part of the archipelago is included in a line drawn east and west, south of Maka-pu; south of that line the position of the southwestern reef can be traced only by the discoloration of the waters.

Manga Reva is an intermediate stage of erosion and denudation, between a lagoon archipelago such as Truk and a barrier reef island like Vanikoro, and other islands in the Society groups such as Bora Bora,* Huaheine, Raiatea, Eimeo, in which the surrounding platform has comparatively little width and the barrier reef is close to the principal island and often becomes part of its fringing reef. Manga Reva is open to the south and to the west, Vanikoro to the east, while the volcanic islands of Truk

* See A. Agassiz, 'The Coral Reefs of the Tropical Pacific,' plates 210 and 231.

are completely surrounded by the outer encircling barrier reef, as are the Society Islands just mentioned, which have several wide passages into the lagoon through the wide barrier reef.

One is tempted to reconstruct the Gambier archipelago of former times, and to imagine it with a great central volcano, of which Manga Reva and Au Kena are parts of the rim which once were connected from the southeast point of Manga Reva to Au Kena, and thence along the line of the outer islets to the northeast end of the former island with a deep crater of more than 34 fathoms. On the west face it was flanked by smaller craters extending to the western islets of the barrier reef, of which the bays of Taku, Kirimiro and Rumaru, and the bays of the west side of Tara Vai are the eastern ridges. There were probably also other secondary volcanoes, of which Aka Maru and the islets of the south part of the lagoon are the remnants, the latter all being situated on the gentle slope of the southern part of the Manga Reva plateau; this may have been the southern slope of the principal volcano of the group, on the face of which have grown up the outer lines of the barrier reef and its islets.

The existence of a great central volcano would readily explain the great depth of the lagoon in its different regions, as well as the great depth off the outer face of Manga Reva, depths showing slopes which are no steeper nor more striking than the height and slopes of the southern part of Manga Reva or Tara Vai, of Aka Maru and of Maka-pu, supposing them to be extended into the sea.

Mt. Mokoto and Mt. Duff drop precipitously for more than one third their height and in less than a quarter of a mile fall from over 1,300 feet to the level of the sea. Similar slopes are found along the volcanoes of Easter Island where there are no coral reefs. The edge of the crater of Rana Kao drops perpendicularly a height of nearly 1,000 feet in less than one eighth of a mile horizontal distance; and the eastern face of the crater of Rana Roraka rises vertically about 800 feet above the plain of Tangariki.

It is interesting to note how poor is the flora of the Manga Reva archipelago as compared with that of the more western volcanic islands like the Marquesas and the Society Islands and some of the western elevated Paumotus. In the Gambier Archipelago the forests are reduced to a few patches extending along the small valleys of the slopes of the volcanic spurs. I am informed that even in the thirties of the last century, when the missionaries first landed at Manga Reva, the forest trees, while more numerous, yet never attained the luxuriance of growth that they attain in the Society and Marquesas Islands. At the present day, with the exception of the forest patches just mentioned and a few trees which have been introduced for cultivation, the islands of the group are in great part thickly covered with a species of cane closely resembling that of our southern states. The fauna of Manga Reva is also extremely poor. There are no mammals, and with the exception of a 'sandpiper' no indigenous birds. Sea birds are few in number, and in our trip in the eastern Pacific we rarely had more than three or four birds accompanying us; often only one, and frequently none was visible for days. There are a few lizards on the islands, apparently of the same species as those in the Society Islands.

We left Port Rikitea for Acapulco on the fourth of February to anchor off Aka Maru; on the fifth we left our anchorage, sounded off the east face of Manga Reva, and took photographs.

On our way north from Manga Reva to Acapulco we did not begin to trawl or tow until warned by the surface nets that the

surface was becoming richer in animal and vegetable life and also by the surface temperatures indicating that we had reached the southern edge of the cold western equatorial current. A little north of 10° south latitude we made our first haul and deep tow, and found a very rich fauna down to the 300-fathom line, recalling the pelagic fauna of the eastern lines and fully as rich. On trawling we found, as we expected, a very rich bottom fauna.

Among the animals brought up in the trawl there were some superb *Hyalonema*, siliceous sponges, *Benthodytes* and other deep-sea holothurians, fine specimens of *Freyella*, and some large ophiurans. This haul is interesting as showing that in the track of a great current, with abundance of food, we may find at a very considerable depth (2,422 fathoms) an abundant fauna at very great distances from continental lands. We were, at this station, about 2,140 miles from Acapulco, 1,200 miles from Manga Reva, 1,700 miles from the Galapagos and about 900 miles from the Marquesas.

Another haul made under the equator near the northern edge of the cold current in 2,320 fathoms gave us the same results. The pelagic fauna was very abundant, the surface teemed with radiolarians, diatoms and Globigerinæ, and swarmed with invertebrates. The trawl contained a superb collection of bottom species of holothurians, *Brisinga*, *Hyalonema*, *Neusina*, and on this occasion we brought up the only stalked crinoid collected during this expedition—parts of the stem of two specimens of *Rhizocrinus*, of which, unfortunately, the arms were wanting.

Our progress, which was excellent during the first days of our journey after leaving Manga Reva, has for the past six days been greatly impeded by head winds in the region where we ought to have been in the full swing of the southeasterly trades. This led us, with great reluctance, to abandon all idea of further work in the equatorial belt of currents; to give up our proposed visit to Clipperton, and on account of our limited coal supply, to make for Acapulco, merely sounding every morning. This was a great disappointment to me, as we had every reason to expect to be able to spend some time in the region of the equatorial current belts and settle more conclusively than we have been able to do the question of their influence upon the richness of the fauna living in their track far from continental shores or insular areas.

The presence of diatoms in all parts of the Humboldt Current, which we crossed from south of Callao to the equator at the Galapagos and west towards Clipperton, shows how far the track of a great oceanic current can be traced, not only by its temperature but also by the pelagic life within or near it. When once in the warm westerly equatorial current the diatoms disappear and the bottom samples show only surface radiolarians and Globigerinæ.

We took a number of serial temperatures in the line Galapagos-Manga Reva, passing from the colder water of the Humboldt Current to the warmer waters south toward Manga Reva. The temperatures at 200 fathoms became nearly identical. North the great change in temperature took place between 25 and 200 fathoms, where there was a difference of 24°. South the warm water extended 100 fathoms, a great change occurring between 100 and 200 fathoms, a drop of 16°. The serial temperatures taken at the southern and northern edges of the cold current on the line Manga Reva-Acapulco agreed well with those taken in the same current to the east.

The samples of the bottom obtained by the soundings taken by the expedition or gathered in the mud-bag and in the trawl

indicate that an immense area of the bottom of the eastern Pacific is covered with manganese nodules, and that they play an important part in the character of the bottom, not only in the area covered by this expedition; the area of manganese nodules probably extends to the northwest of our lines to join the stations where manganese nodules were found by the *Albatross* in 1899 in the Moser Basin, on the line San Francisco-Marquesas. This area may also extend south of our lines Callao-Easter Island, and join the line west of Valparaiso, where the *Challenger* obtained manganese nodules at many stations. I do not mean to imply that the manganese nodules are present to the exclusion of radiolarians and of Globigerinæ. It is probable that the layer of nodules is partly covered by them, and by the thick, sticky, dark chocolate-colored mud which is found wherever manganese nodules occur.

During this expedition we sounded every day while at sea and developed very fairly that part of the eastern Pacific which lies to the south and west of the line from Cape San Francisco to the Galapagos and west of a line from Galapagos to Acapulco, limiting an area occupied by the *Albatross* in 1891. The area developed by us is included by a line 3,200 miles in length from Acapulco to Manga Reva and the area north of a line from Manga Reva to Easter Island and from Easter Island to Callao. We developed on our line Galapagos to Manga Reva the western extension of the Albatross Plateau, and found it of a depth varying from 1,900 to somewhat less than 2,300 fathoms in a distance of nearly 3,000 miles; but about half-way from the Galapagos to Manga Reva we came upon a ridge of about 200 miles in length with a depth of 1,700 to 1,055 fathoms, dropping rapidly to the south to over 1,900 fathoms. I propose to call this elevation Garrett Ridge.

Our line from Manga Reva to Acapulco continued to show the western extension of the almost level bottom of the eastern Pacific. In a distance of 3,200 miles the depth varied only about 400 fathoms. This great area was practically a *mare incognitum*. Three soundings in latitude 20° south towards the Paumotus and five soundings in a northwesterly trend from Callao to Grey Deep are all the depths that were known previously of this great expanse of water. This existence of the great plateau dividing Barber Basin along the South American coast from Grey and Moser Basins to the west is most interesting. It recalls the division of the southern Atlantic into an eastern and western basin by a central connecting ridge. The Albatross Plateau joins the western extension of the Galapagos Plateau as developed by the *Albatross* in 1891.

The existence of a sounding of 2,554 fathoms near the equator in longitude 110° west would seem to indicate a small basin included in this plateau disconnected from Grey Deep and Moser Basin by its extension to the west. How far west towards these basins that extension reaches no soundings indicate as yet. It is interesting to note that along the Mexican coast there are a number of deep basins lying disconnected close to the shore just as we found a number of disconnected deeps close along the South American coast extending from off Callao to off Caldera, Chili, opposite high volcanoes or elevated chains of mountains. These basins and a great part of the steep Mexican continental shelf are deeper than the Albatross Plateau to the south and form a deep channel separating in places the plateau from the steep continental slope. The steepness of the continental shelf is well seen, especially off Acapulco and Manzanilla. One of the small basins along the Mexican coast, with 2,661 fathoms, lies off Sebastian Viscaino Bay; another, with more than 2,900 fath-

oms, is to the west of Manzanilla Bay; a third, to the southeast of Acapulco, has about the same depth, and a fourth, with 2,500 fathoms, is off San Jose, Guatemala. Our last sounding off Acapulco about 29 miles south of the lighthouse, in 2,494 fathoms, showed the western extension of one of these deep holes to the east of Acapulco. These basins off the west coast, close to the shore at the foot of a steep continental slope, are in great contrast to the wide continental shelves which characterize the east coast of Central America and the east coast of the United States.

The collections made during the present expedition will give ample material for extensive monographs on the holothurians, the siliceous sponges, the cephalopods, the jelly-fishes, the pelagic crustaceans, worms and fishes of the eastern Pacific, as well as on the bottom deposits and on the radiolarians and dinoflagellates, diatoms, and other protozoans collected by the tow nets. Small collections of plants were made at Easter Island and Manga Reva which may throw some light on the origin and distribution of the flora of the eastern Pacific.

SCIENTIFIC BOOKS.

Radioactivity. By E. RUTHERFORD, D.Sc., F.R.S., R.R.S.C., MacDonald Professor of Physics, McGill University, Montreal; Cambridge Physical Series. Cambridge, University Press, 1904.

Within recent years books dealing specifically with radioactivity or the cathode rays have naturally not been infrequent. Beginning with the pioneering treatise of Stark ('Elektricität in Gasen,' 1902), Madam Curie's account of radioactive substances, Villard's 'rayons cathodiques,' G. C. Schmidt's 'Kathodenstrahlen' (1904), Besson and D'Arsonval's 'Le radium' (1904), Blondlot's 'rayons N' (1904) and others, have followed in quick succession. But Mr. Rutherford's book is on quite a different scale from most of these, and written in a way that betrays consummate mastery of the subject. One would have been grateful if he had given us merely a systematic account of his own researches. The book before us does much more than this, presenting a readable and most painstaking digest of the subject as a whole, or at least of that splendid part of it which owes its development chiefly to English genius.

In the introductory part separate chapters are devoted to radioactive substances, to the theory of ionization, and to methods of measurement. Then comes a long account of the nature of the radiations. The sharply articulated descriptions which follow, and the suggestions lavishly offered for the completion of most of them, are a feature of the book here and in succeeding chapters. The short account of the rate of emission of energy is absorbingly interesting, and would be startling if our expectation were not blunted by the expressions of astonishment so much in vogue in connection with this subject. In the chapter on radioactive matter, Mr. Rutherford develops the important principle that the activity of a product at any time is proportional to the number of atoms which remain unchanged at that time, a subject to which he has himself so prolifically contributed. This is supplemented by a long chapter on radioactive emanations, giving a succinct account of the work for which the Rumford medal of the Royal Society was recently awarded.

The interesting phenomenon of excited radioactivity, of which Rutherford shares the honor of discovery with the Curies, is next discussed in detail and leads naturally to the final résumé on radioactive processes, in which the full theory of atomic disintegration is developed. The consequences of this theory have been brilliantly substantiated, even in the more recent papers which Rutherford contributed to the congress at St. Louis and elsewhere. At the end of the chapter is a summary of the present state of our knowledge of the age of the sun and of the earth. The book closes with an account of the radioactivity of ordinary materials.

We have noticed but few misprints: p. 55, m for u; p. 265, t for n; p. 336, omission of dt. We should have been grateful, however, for a

more generous use of italics. Mr. Rutherford is apt to express himself with no uncertain sound against the interminable drawl of less gifted investigators. Nevertheless, the subject of radioactivity, which is now in the glare of the footlights, may not be there indefinitely, and a more liberal variegation of the text for the benefit of the lazy reader, may not in any case be an unreasonable condescension.

To have produced a fresh book, broad in scope and accurate in its statements, on a subject which has now for years been the chief topic of animated discussion in the physical and other magazines, is Mr. Rutherford's great merit in this work, quite apart from its character as a summary of original investigation.

Carl Barus.

Brown University,
Providence, R. I.

Die Ernahrung der landwirtschaftlichen Nutztiere. Von Dr. O. Kellner, Geh. Hofrat und Professor, Vorstand der Kgl. landw. Versuchstation Möckern. Berlin, Paul Parey. 1905. 8vo. Pp. viii + 594. Cloth. Price 13 Marks.

Notwithstanding the vast amount of investigation upon stock-feeding problems which has been carried on during the last forty years in the experiment stations of Germany and later of the United States as well as to a certain extent elsewhere, it is unfortunately true that the theoretical basis of the subject has shown relatively little advancement since Henneberg's earlier researches in the sixties. We still, as then, reckon largely with the so-called 'digestible nutrients' (protein, carbohydrates and fat) and still assume that their amount measures, at least approximately, the nutritive value of feeding stuffs. True, we have had an uneasy consciousness for some time that this was far from being strictly correct, but in the absence of any better method of comparison we have rather blinked the fact and each writer has followed in the footsteps of his predecessor with, perhaps, the addition, of late years, of some more or less critical statements regarding energy values.

Dr. Kellner's book marks a new departure in the literature of the subject. Its well-known author was the first to suggest, in the year 1880, in connection with investigations upon the nutrition of working horses, that the values of different feeding stuffs might be compared upon the basis of their content of potential energy. Within a comparatively few years thereafter the study of the food as a source of energy to the animal organism was systematically taken up by Rubner and the foundations of the subject were laid. Since then a large amount of investigation upon the nutrition of carnivorous animals and of man has been executed in which Rubner's work has furnished the guiding idea. As regards the nutrition of domestic herbivorous animals, however, scarcely any investigations had been made from this standpoint when, in 1893, Dr. Kellner was called to the directorship of the Möckern Experiment Station. There he at once took up the subject, his first results and an outline of his methods being published in 1896. Since that time the work has been carried forward vigorously under his direction and most important results have been secured.

The present book embodies the results of Kellner's investigations, including many that have as yet been published only in abstract, but covers a much broader field than a mere compendium of this work and is an attempt to treat the subject of stock feeding systematically from the new standpoint. The book is divided into three parts. Part I. treats of the composition, digestibility and utilization of feeding stuffs, containing chapters upon the constituents of feeding stuffs, the digestibility of the feed, the utilization of the digested materials in the animal body, the metabolism of matter and energy under various conditions and the influence of muscular work on metabolism. Part II. treats of feeding stuffs, covering such subjects as methods of harvesting and preserving, the preparation of feeding stuffs and a somewhat detailed description of the different feeds. Part III. treats of the feeding of farm animals under the conditions of agricultural practise, including maintenance feeding, the fattening of mature animals, the feeding of working animals, the feeding of

growing animals and the feeding of milking animals.

Part I., and especially the chapters upon metabolism, will be of much interest to the student of nutrition in general, but the special value of the book is found in Part III., in which is made the first serious attempt to apply the more recent knowledge regarding the energy relations of feeding stuffs to practical use. It abandons definitely the assumption which has underlain nearly all previous works of this character that the digestible nutrients, so-called, of a feeding stuff are a measure of its value. In place of this, Kellner puts the actual productive value as worked out by his own investigations and which is shown to differ very widely in many cases from the indications given by the digestible nutrients. While he does not fail to point out that the basis for an undertaking of this sort is still somewhat narrow, yet he believes that the time is ripe for a beginning. He has accordingly, in the appendix, given a series of tables in which the productive value of feeding stuffs is estimated, largely upon the basis of his own results, while the so-called feeding standards are also expressed upon the same basis.

While it is, perhaps, to be regretted that the author has expressed his feeding values in the form of starch equivalents instead of boldly adopting the terminology of energy, and while it can not be denied that his tables are based to a considerable degree upon estimates, nevertheless the book promises to mark a distinct stage of development in the theory of stock feeding and will be welcomed by the large number of those who have become dissatisfied with the present conventional methods in this subject.

H. P. ARMSBY.

SCIENTIFIC JOURNALS AND ARTICLES.

THE contents of the *American Journal of Mathematics* are as follows:

ALEXANDER CHESSIN: 'On a Class of Differential Equations.'

L. P. EISENHART: 'Surfaces with the Same Spherical Representation of their Lines of Curvature as Pseudospherical Surfaces.'

VIRGIL SNYDER: 'On the Forms of Sextic Scrolls having no Rectilinear Directrix.'

LEONARD EUGENE DICKSON: 'Determination of the Ternary Modular Groups.'

THE April issue of the *Journal of Nervous and Mental Disease* opens with a paper by Dr. William P. Spratling and Dr. Roswell Park, on 'Bilateral Sympathectomy for the Relief of Epilepsy,' with report of three cases, and notes on the physiologic effects of cutting the sympathetic, and on the histologic changes found in the cases in question. The microscopical findings are illustrated by two plates. Dr. F. W. Langdon follows with a paper on myelomalacia, with especial reference to diagnosis and treatment, illustrated by charts, and Dr. Arthur Conklin Brush discusses the medico-legal aspects of traumatic epilepsy. The Society Proceedings reported this month include the meeting of the Boston Society of Psychiatry and Neurology held November 17, 1904, and that of the Chicago Neurological Society of the same date.

SOCIETIES AND ACADEMIES.

THE GEOLOGICAL SOCIETY OF WASHINGTON.

THE 166th meeting was held on March 22. The regular program included:

The Coal Measures of Brazil: Dr. I. C. WHITE.

Dr. White discussed the character and distribution of the coal-bearing beds of southern Brazil. The series consists of coarse conglomerates, and gray sandstones at the base, alternating with blue and gray shales up to 350 to 400 feet above the granite upon which the measures rest in the states of Santa Catharina and Rio Grande do Sul, where his principal studies were prosecuted during the past year. Above these basal sandstones, the coal beds occur three to four in number through a thickness of 200–250 feet of alternating gray sandstones, clays and shales. There are two principal coals, the 'Bonita' bed at the base, and the 'Barro Branco' near the top of the coal series. The coal is high in both ash and sulphur, but can be used successfully for locomotives, stationary boilers, etc., in a region where imported coal costs not less than $10 per ton at the seacoast.

Above the coal-bearing member succeeds a series of sparingly reddish clays, and gray sandy shales and sandstones which are followed by light blue shales up to a horizon of dark limy shales which in the states of Paraná and São Paulo contain numerous reptilian remains, *Stereosternum tumidum* of Cope having been found at this horizon, as well as many fossil stems of trees, etc.

Dr. White found at this horizon in Paraná what Osborn pronounces a new form, specifically and possibly generically different from Cope's. It resembles *Mesosaurus tenuidens* of Gervais from the Karoo beds of South Africa.

Above the black shales, *red beds* of alternating shale and sandstone become conspicuous, while capping the same is a great massive conglomerate sandstone often baked and vitrified by the immense outflows of diabase, and basaltic eruptives which penetrate the series at all angles, and which piled in enormous masses on top of the sedimentaries make up the Serra Geral. The entire sedimentary series has a thickness of 2,250–2,500 feet.

Two prolific horizons for fossil plants were discovered by Dr. White, one only 200 feet above the base of the series, and the other 150 feet higher. In these was discovered the genus *Glossopteris* and other forms, some of which are new to science, and which have been entrusted for study and description to Mr. David White. The evidence from the fossil plants and animal remains appears to place these rocks in the Permian, and to correlate the formation with the Karoo beds of South Africa, and the Gondwana series of India.

The Dwyka and Talchir conglomerates of those countries appear to have a corresponding representative in the coarse conglomerates which rest upon the granite in Santa Catharina and Rio Grande do Sul, fifty to sixty miles inland, from the Atlantic coast.

Dr. White will return to Brazil during the present summer to finish up his studies of this coal series for the Brazilian government.

Flora of the Brazilian Coal Measures: Mr. David White.

The paleobotanical material collected by Dr. I. C. White was discussed with special reference to its relation to the *Glossopteris* province. The greater part of the material is from two horizons and localities. The first, near Minas, Santa Catharina province, in a bed below the productive coals and only about 200 feet above the old crystallines, reveals *Glossopteris indica, Gangamopteris obovata, G. cyclopteroides, Phyllotheca* cf. *australis* and *Noeggerathiopsis Hislopi,* besides several new generic and specific types. The second important collection, from the roof of the Irapua coal, in the province of Rio Grande do Sul, at a horizon determined by Dr. White as about 150 feet higher, it being among the productive coals, contains *Glossopteris indica, Noeggerathiopsis Hislopi, Ottokaria* sp. and *Cardiocarpon* sp. The occurrence of *Lepidodendron Pedroanum, Lepidophloios laricinus* and the lepidophytic spores, previously reported from Brazil and especially interesting as showing the contact of the Glossopteris, or Paleoantarctican, flora with the northern Carboniferous flora, becomes all the more interesting and important in view of their local stratigraphic position which was found by Dr. White to be still a little higher than that of the plants last named. The inclusion of southern Brazil in the Indo-Australo-South African or 'Glossopteris' province is, therefore, fully confirmed by the evidence thus brought to hand. The *Glossopteris,* found abundant though fragmentary at Irapua, represents the form described by Seward from South Africa, where it is similarly associated with representatives of the northern lepidophytes. The new material tends to corroborate the conclusion reached by M. Zeiller, that the Brazilian coals are probably of Permian or possibly latest Coal Measures age, their place being apparently in the Karharbari-Newcastle stage.

Mr. W. T. Schaller described the 'Tourmaline Mines of California.'

Geo. Otis Smith,
Secretary.

The Chemical Society of Washington.

The 158th regular meeting of the society was held Thursday evening, April 13, in the

Assembly Hall of the Cosmos Club. The following program was presented:

The first paper for the evening was delivered by Dr. N. Monroe Hopkins, upon 'The Construction and Operation of Small Electric Furnaces.' The necessary apparatus and appliances were exhibited and a description of the construction and operation of several furnaces was given.

Dr. Chas. W. Waidner, of the National Bureau of Standards, delivered an address upon 'Available Methods of Measuring Temperature.' Numerous stereopticon illustrations were shown and specimens of various forms of thermometers, pyrometers, etc., were described and exhibited.

An adjourned meeting of the Chemical Society of Washington was held Saturday evening, April 15, 1905, in the chemical lecture hall of the Johns Hopkins University, Baltimore, Md.

After a short address of welcome to the Washington members by President Remsen, the following program was presented:

The first paper, entitled 'A New Combustion Furnace,' was presented by Dr. H. N. Morse. A complete furnace connected up ready for operation was shown on the lecture table and a full description of the construction, uses and advantages of the new furnace was given.

The second paper, entitled 'New Appliances in the Works Laboratory,' was presented by Dr. Edward Kellar. A stirring and also filtering apparatus, providing for the manipulation of a series of solutions at a single operation was illustrated and described. A number of improved tongs, etc., for use in handling sets of scorifiers, lead buttons, cupels, etc., at one time in fire assays, were shown and their use described.

A paper entitled 'New Evidence Bearing upon the Existence of Hydrates in Solution' was presented by Dr. H. C. Jones.

The last communication of the evening was presented by Dr. G. W. Lehmann, who gave a description of the investigations which the health department of Baltimore has recently instituted to determine if possible whether the high infantile mortality in certain sections of Baltimore could be connected with the milk supply of those sections of the city. The results of the investigation indicated that the trouble was probably due to inferior brands of condensed milk which are consumed in large quantities by the residents of south Baltimore.

A. SEIDELL,
Secretary.

THE AMERICAN CHEMICAL SOCIETY, NORTHEASTERN SECTION.

THE fifty-ninth regular meeting of the section was held on Friday evening, March 31, at the 'Tech Union,' Massachusetts Institute of Technology, with President Norris in the chair. About 100 members were present.

Mr. George W. Rolfe was elected a member of the executive committee to fill the vacancy caused by the death of Dr. C. O. Weber.

A eulogy of the late Mr. Frederick J. Warren was read by Mr. Robert S. Weston.

The meeting was devoted to a discussion of the subject, 'Expert Chemical Evidence.' Mr. Arthur D. Little opened the subject with a historical introduction, and treated the subject from the side of an expert in patent causes. Professor E. J. Bartlett described the procedure and position of an expert witness in criminal cases. Professor Henry Carmichael discussed some of the evils of present court procedure in relation to the positions, and the qualifications necessary for a successful expert. Dr. B. F. Davenport gave a reminiscent account of varied experiences as an expert witness. Professor L. P. Kinnicutt discussed the position of the expert in relation to his clients and the court. Mr. A. E. Leach described the position of the state expert in cases of prosecution for infractions of the pure food laws. Professor S. P. Sharples discussed the position of the expert towards the lawyer, who is conducting the case for his client.

ARTHUR M. COMEY,
Secretary.

THE SCIENCE CLUB OF THE UNIVERSITY OF WISCONSIN.

THE seventh meeting of the club for the year 1904–5 was held on Tuesday, April 18,

at 7:30 P.M., in the physical lecture room, Science Hall. The program of the evening consisted of an address by Dr. L. Kahlenberg, on the subject, 'The Nature of the Process of Osmosis.' The speaker presented the main results of an extensive experimental study of osmotic phenomena in which so-called semipermeable membranes have largely figured. Much of the work was done with non-aqueous solutions of various kinds. The speaker held that the substance which passes through the membrane dissolves in the latter, and is extracted from the resulting quasi-solid solution by the liquid bathing the other side of the membrane. He showed that whether osmosis will take place or not depends upon the nature of the membrane and the liquids in contact with it. On the basis of the views set forth, he could furthermore predict in which direction osmosis would take place and specify which substances would pass through the membranes.

The quantitative measurements of osmotic pressures were made with a new and unique form of apparatus, the results obtained with semipermeable membranes showing that the osmotic pressure does not follow the gas laws. The views of osmosis set forth are much like those of Overton who worked along physiological lines. It is of special interest to note that the speaker found cases where colloids pass through membranes much more rapidly than crystalloids, thus furnishing instances in which the commonly accepted views which we owe to Graham are completely reversed. The results of this investigation will be published in detail by the speaker in the near future.

F. W. Woll,
Secretary.

THE TORREY BOTANICAL CLUB.

At the meeting of the club held on March 29, 1905, at the New York Botanical Garden, Vice-President Underwood in the chair and twenty-three additional members present, the following papers were read:

'Remarks on Californian Conifers,' by Le Roy Abrams. The conifers of California have been of extreme interest to the botanical world from the time that that country was first explored. Nowhere do we find such unique trees as the sequoias, and nowhere is there such a profusion of genera and species. Nearly two thirds of the species of the United States, and all but two of the genera occur within the state. The distribution of these species, especially of some of the more local ones, is of considerable interest, and it was upon this subject that Mr. Abrams chiefly dwelt.

By far the greater number of species occur in the extreme northern part of the state. Here, within a radius scarcely exceeding one hundred miles, no less than eleven genera and at least thirty species may be met with. This great profusion is mainly due to the fact that we have in this region a mingling of the typical Californian species with those of the northwest.

Nearly all of the local species are confined to the coastal region. Some of these, such as *Pinus Torreyana, Abies venusta* and *Cupressus macrocarpa,* are extremely local, indeed. The causes of this peculiar distribution along the coast are of great interest and suggest a field for investigation which is full of untold possibilities. Mr. Abrams was of the opinion that present climatic conditions together with the broken and unconnected mountains were no doubt largely responsible for the present status of distribution. He suggested that the great changes in land areas to which this region has been subjected during very recent geological time must have had much to do with shaping the destiny of the flora.

After considerable discussion adjournment followed.

Edward W. Berry,
Secretary.

THE ELISHA MITCHELL SCIENTIFIC SOCIETY OF THE UNIVERSITY OF NORTH CAROLINA.

The 160th meeting of the Elisha Mitchell Scientific Society was held in the Chemical Lecture Room, Tuesday, 7:30 P.M., April 11, 1905. The following papers were given:

Professor J. E. Latta: 'The Edison Storage Cell.'

PROFESSOR H. V. WILSON: 'The Organization of the Ovum.'

PROFESSOR COLLIER COBB: 'Autophytographs.'

A. S. WHEELER,
Recording Secretary.

DISCUSSION AND CORRESPONDENCE.

A PLEA FOR INCREASED REVIEWING OF SCIENTIFIC LITERATURE.

IT has seemed to the writer that more attention should be given to reviewing current literature in zoology, and I am told that the need is greater in some other sciences. It is not necessary to dwell upon the small number of universities in which the library facilities may be called good, upon the fact that our students are slow to gain a ready knowledge of the three or four foreign languages in which appears an increasing volume of scientific literature, or upon the heavy duties in teaching and administration with which our staffs of instruction are burdened. These conditions make reviews of literature especially useful to American men of science. There are, however, more fundamental reasons why the scientific body should pay more (and more serious) attention to reviewing its recent work. The first is that scientific efforts are very manifold and diverse and the output is very great and increasing. Beyond a certain limit, without an increase in the unifying forces, these efforts are bound to become discrete and diffuse. I believe that this limit has been reached. That the same belief is held in Europe is perhaps to be inferred from the great increase in reviewing in the last few years in Germany.

A second reason is that the review should be an important means for the training of investigators, and for leading students to become investigators. This function of the review has, I believe, not been sufficiently recognized, and it is this which especially interests us in America. By reviews the writer does not mean abstracts, which seek to furnish information by a short and easy method. Reliance on abstracts impoverishes and blunts the mind and is dangerous to the true spirit of investigation. Reviews which are essentially abstracts of isolated papers are of doubtful value. Because isolated, they do not aid the student in gaining a broad and fundamental understanding of the field; because abstracts, they can not be relied upon by the investigator; and they are longer than necessary to serve as a guide to the literature.

There are two ways in which reports or reviews may serve a useful purpose: first, as an annotated bibliography or guide; second, as a comprehensive presentation of the work done in a given field. These two legitimate kinds of reviews are quite distinct in their form and purpose. The annotated bibliography is useful to the specialist and instructor. For those who have not a large library at their disposal a mere list of titles is insufficient. It is necessary in addition to have certain information about a paper in order to know whether it is important for one's immediate purpose. It is greatly to the credit of Mr. Field that some of this information has been included in the Zurich bibliography. Fuller information is given in several journals of the *Centralblatt* type in Germany. In America in a special field the same kind of work is being done by the *Journal of Comparative Neurology and Psychology* through the joint efforts of its collaborators. Whether other journals might not well undertake similar work in their fields may, perhaps, better be discussed by others. In no journal with which I am acquainted are the reviews uniform in character or restricted to the kind of information here suggested. To make my meaning clear I may enumerate what, in my opinion, should be included in these brief reviews. Besides the author, title, date and place of publication, number of pages, figures and plates, and price of a book, there should be stated: (1) the material and methods, (2) the subjects treated, (3) the general purpose aimed at or end attained and (4) the reviewer's judgment as to the adequacy of the methods and the reliability of the results, in cases where the paper can be definitely characterized. Such reviews might occupy from six to twenty lines and when printed over the reviewer's signature would constitute a valuable guide for the advanced student and instructor.

The second form of review is useful to the instructor and should be especially valuable

to the student who is pursuing his first piece of investigation or who is about to choose his subject. Probably no one thing would bring greater or surer return in the way of the advancement of science than an adequate means of introducing students to the original literature of their respective subjects and helping them to appreciate the historical perspective and the current tendencies of thought. This can not be done by reviews of isolated papers, nor to any great extent in courses of instruction. It can be done where a large enough number of students come together in a journal club or seminar, but best of all by the historical and critical review. The student is usually left to gain a practical knowledge of the literature in connection with his first piece of research, and thus suffers in two ways. First, a large amount of time is consumed in learning how to handle and judge the literature, which could be saved *in part* by an acquaintance with specimens of critical treatment. Second, he has not time in this way to gain a knowledge of many subjects. If he had at command before beginning research critical reviews of the several branches of his science he would certainly be able to choose a line of research more wisely, and would be in a better position to follow up the literature of fields other than his own. With our present method of instruction such reviews could very well serve as text or reference books to accompany lectures. They could be more accurate and better brought up to date than present text-books and would serve the purpose better for all except elementary students. Such reviews should aim to give the development and present status of the subject treated by means of a summary and criticism of the literature. The wide knowledge and judicial attitude necessary require that they be written by men who have completed more than one considerable piece of investigation and have had successful experience in teaching.

Granting the value of such reviews, two objections will doubtless be made. First, such work is already being done in Germany and we profit by it. Second, it is very difficult for an American university man with his manifold duties to accomplish such a piece of work as a historical review. Few men will be found willing to devote such time as they have to this in preference to investigation. With regard to the first objection, it would also be true to say that this work is being done in Germany and we lose by it. By this I mean that a great deal of good American work is either overlooked or misjudged by Europeans. Reviews written by capable Americans under favorable conditions would be more complete and better balanced and would be more useful to the American student. It should be remembered that the prospective or beginning investigator in our universities has yet to gain such facility in German that a Referat of a hundred or more pages shall be a delight to him. However, putting comparisons aside, there is room for reviewing in addition to that to be found in foreign languages, and I would not advocate the repetition in English of work which was already done in another language.

The second objection calls for a plan whereby we can secure such work by capable men under favorable conditions. Considering that critical work involving the organization of many details requires maturity of thought, a review of this kind must be the work of several months for an experienced investigator. A working year should be allowed in order that original investigation may be carried on at the same time. The best work would be done by men appointed each for a single review in his special field. The stipend should be liberal, say fifteen hundred dollars. The ground covered would be some well-defined field in one of the natural sciences. Whether such a review would be prepared each year in some field of each science or less often would be determined by the board who had the matter in charge. With regard to financial support and administration, the writer can only suggest possibilities. The first thought is that the Carnegie Institution might well do this work unless the terms of the foundation prevent. Or, a special endowment for this purpose might be given by some man interested in scientific progress. Or, the American Association for the Advancement of Science might secure a fund and appoint a board to carry on the work. Or, finally, since the uni-

versities are the chief means for the advancement of science and since the results would have direct relation to the work of instruction, a plan might be devised by which a number of universities would jointly provide for it.

In conclusion, if this be thought worthy of further discussion, let the motive of the writer's suggestion be clear. It is the advancement of science in America by means of organized reviewing of current literature as an aid in the development of the future investigator. This may be regarded by some as in the nature of 'coddling' which would lead into scientific work those who are unfit and who would not succeed. No one is less inclined than the writer to give undue encouragement to students. On the other hand it is an open question whether science is not now losing fit persons for want of some such introduction to the workshop. It is not desired that the literature should be brought down to the level of the average student. The reviews should be written for the serious man who is seeking his proper place and the opportunity to do work.

J. B. JOHNSTON.

NAPLES,
November 29, 1904.

THE ORIGIN OF CYCLONES, TORNADOES AND COLD WAVES.

TO THE EDITOR OF SCIENCE: As it seems still to be held that the origin of cyclones, tornadoes and cold waves is matter of debate I beg to offer a résumé of an article on that subject contributed some twenty years ago to the *Educational Courant* of Louisville, Ky., and which at the time received somewhat extensive notice.

The contention of that article was that cyclones arise exclusively over tropical islands. It is quite obvious that the movement of the atmosphere over every island that has a sea-breeze as well as above every local fire, must be cyclonic. The vast majority of such cyclonic movements disappear with the reversal of the breeze which occurs at night. But now and then, under particularly favoring conditions, it happens that over a tropical island the cyclonic movement gains such force as to enable it to ascend to a great altitude, and this results in such concentration of vapor and consequent evolution of heat as to supply a new force for the continuation of the movement.

Now the trade winds on their equatorial border describe a loop, while passing from the southwesterly movement below to the northeasterly above, in such way that the wind in those situations may be very swift at considerable altitudes over regions of calm below.

Say one of the daily cyclones described arises over one of the Cape Verde Islands off the coast of Africa, or over one of the Windward islands, and let the conditions be such that when the cyclonic movement attains a considerable height it is caught in the loop of the trade winds moving to the westward. It will be carried to the west along the southern border of the loop, the strength of the southerly flow of the trade winds being sufficient to prevent the upper return or northerly flow from carrying it to the north. But in the course of its journey it enters a region where friction due to the continental mainland has largely interfered with the trade winds, and which interference has resulted in a weak movement of the trade winds of the surface as compared with the return winds above—this retardation after the cyclone has turned and begun its journey to the eastward. There must then be some close connection between them; a connection that would suggest the relation of cause and effect. But how can the low produce the high and its resulting cold wave. If we take into consideration the three facts that the cyclone itself is moving eastward at the rate of 20 or more miles an hour; that at the same time it is revolving contra-clockwise so that its northern segment has a potential westward movement of thirty or forty miles per hour; and, third, that there is a constant eastward movement of the upper strata of the atmosphere at a rate of perhaps seventy-five miles per hour—the situation becomes much simplified.

The periphery of the cyclonic mass on its northern side, moving as it does to the west, meets the air of the constant eastward current and backs or dams it up, thus producing

the high almost invariably observed on the northwestern quadrant. The air thrown or carried up through the funnel of the cyclone remains in this situation more than in any other part of the region corresponding to the circumference of the cyclone. For to the south at this high level the translatory and rotatory movements correspond to and in a large measure neutralize each other. To the west the current of the cyclonic mass is transverse and not counter to the constant overcurrent, and besides, the flow having just emerged from the great friction of the northern side, has had its mass deeply shorn when it leaves the northwestern quadrant. On the eastern aspect, the masses of air carried up and thrown out by the cyclone move onward even at a more rapid pace with the overcurrent and are carried out of the way, giving rise to the cirrus clouds usually seen under such circumstances. A high then must accumulate on the northwestern quadrant. As soon as the cyclone has passed any given point, the 'high' begins to flow out in obedience to the laws of equilibrium. To the east it is hindered by the snarly cyclone. To the north it is hindered by the conservation of areas due to the narrowing meridians and perhaps the undertow equatorward. To the southeastward, then, it must escape into the depression created by the passing cyclone.

The blizzard.—If this outflow of the high finds a lofty and long range of mountains running north and south, these will behave as one of the banks of a great river or one side of a river bed in causing the mass to take on a spiral form of movement. By this movement the atmosphere will be continuously climbing obliquely up the mountains on the western side, while on the eastern border of the spiral the cold dry air will be as continuously drawn down from the upper regions. The western blizzard is such a current, and the Texas norther its continuation.

The great majority of our cyclonic 'laws,' however, do not originate in the tropical north Atlantic, but in the tropical north Pacific. They arise over the innumerable islands found in that region, move west till deflected by the Asiatic mainland, carrying rain and moisture to various distances inland, and then they veer around till, caught in the eastward overcurrent, they are carried eastward across the Pacific, the American continent and often across the Atlantic, and far into the eastern hemisphere again before being arrested.

This is not to deny that cyclones may be formed in other ways, though it may be hard to see how; but since cyclones without number are formed over tropical islands ready to start on their travels, how else can it be than that some of them are caught up in the way described and borne away on their earth-girdling journey? D. T. Smith.

SPECIAL ARTICLES.

A CONTRIBUTION TO THE HISTORY OF THE CONTROVERSY OF FLAMSTEED WITH NEWTON AND HALLEY.

The library of the United States Military Academy at West Point owns a fine copy of Flamsteed's 'Historia Britannica Cœlestis' (London, 1712) which is without any manuscript notes or corrections. To one of the fly leaves a single folio leaf was fastened: 'An estimate of the number of folio pages that the Historia Britannica Cœlestis may contain when printed,' which is dated 'The Observatory, Nov. 8, 1704.' On the blank side of this leaf is written, by Flamsteed himself, the words: 'Mr. Flamsteed's Estimate.' The printed folio page is set up in paragraphs, and Flamsteed has written comments opposite to many of them. As other copies of the 'Historia Britannica Cœlestis' probably contain this folio estimate, I will copy here the MS. comments only, not the paragraphs to which they refer.

The first seven lines of paragraph 1 refer to Gascoigne's observations; they are enclosed by a MS. brace; Flamsteed's comment is:

These are not yet printed, being reserved to be inserted in the preface.

The last four lines of paragraph 1 refer to observations of eclipses, Jupiter's satellites, sun-spots, comets, etc., taken with a large sextant, etc., between the years 1675 and 1689 at Greenwich; they are enclosed by a MS. brace; the paper at the margin is torn here, but I make out Flamsteed's comment to be:

Printed at his Mr. John (leaf torn)
charge on bad paper (leaf torn)
not so correct as they ought (leaf torn)
in 100 sheets.

The second paragraph relates to meridional distances, transits, etc., observed between 1689 and 1704. A brace encloses its four lines, and Flamsteed's comment is:
A fair copy of these on 175
sheets was put into Sr. Is. New (paper torn)
hands Mar. 20 1707/8 to be printed.

N. B. The figures that give the year are here somewhat doubtful, but see below.

The third paragraph is divided into numbered sentences. The first seven relate to Ptolemy's and other catalogues of stars; they are included within a MS. brace; Flamsteed's comment is:
These be ready to be transcribed.

Sentence 8 of paragraph 3 (5 lines) relates to the British Catalogue of 3,000 stars; a MS. brace encloses it; Flamsteed's comment is:
These are printed at my own charge.

N. B. The wording here makes it evident that the MS. notes in this handwriting are by Flamsteed himself.

The next four lines of the text have no MS. comment, but the succeeding three are printed as follows:
"The New Figures of the Constellations, or the Ancient Ones restor'd (those in *Bayer,* and on our Globes being false, and different from all the Catalogues in all Languages) in about Sixty Copper Plates, each near Two Foot broad, and Twenty Inches deep, with a Preface."

This sentence is enclosed in a MS. brace and Flamsteed's comment is:
These were altogether necessary and
ought to have been first taken
care of but were designedly
neglected by Sr. Is. N. to spoyle
ye whole.

The next printed words relate to part first of the proposed book. A MS. mark refers to the foot of the page where Flamsteed's MS. comments are written, as follows:
The first part was printed off in October 1707. March 20 1707/8 Sr. Is. Newton had 175 sheets put into his hands to be printed, of which what is become J. F. knows not, save that E. Halley has printed some sorry Abstracts of a part of them without J. F's knowledge and consent.

At the foot of the page are two MS. queries by Flamsteed, as follows:
1. *Qs. What is become of £1200 allowed for ye work per Prince George.*
2. *What is become of all Copies already Printed.*

At the foot of the page there is a line of MS. written by another hand in a different ink, as follows:
Memdm. J. F. told W. L. at ye Treasury Office that E. H. had stolen 2 or 3 of his best fixed stars.

Those who wish to follow the rather complicated quarrel of Flamsteed with Newton and Halley can find a sufficient and fair account of the controversy in the 'Dictionary of National Biography,' Vol. XIX. (Article Flamsteed—see also Newton and Halley). It is of extreme interest to have found Flamsteed's own comments on the controversy. The MS. referred to has, by direction of the Superintendent U. S. M. A., been deposited with the Royal Society of London, which possesses many of the manuscripts of Flamsteed, Halley and Newton.

EDWARD S. HOLDEN.
U. S. MILITARY ACADEMY.

A BETWEEN SEASON BIRD FOOD SUPPLY.

AN apparently unnoticed food supply for birds is found in the heaps of drift, the flotsam and jetsam cast up along the shores of rivers, creeks and other bodies of water. These places are much resorted to by crows, jays and blackbirds, and probably most of the sparrows feed about them from time to time. As they exist during the winter and early spring when food is not easily accessible over the whole country, they are probably welcome stores to our winter birds.

In order to ascertain the character and quantity of available bird food in these drift heaps I filled a half pint tin can with the material, scraping it in at random from the surface of one of them. Besides the bits of

bark, twigs, leaves, etc., I found in this quantity of the drift, by actual count, 1,583 seeds and fruits of more than 55 species of plants. These are without exception substances which have been found in the stomachs of birds. What a rich variety of food there is in the drift heaps, and what a truly enormous quantity there must be in the cast-up material which lines the shores of all of our waters. Besides the vegetable matter there were also several insect pupæ and a few living chrysomelids and weevils.

The following seeds and fruits were contained in a half pint of drift collected along Northwest Branch, Montgomery County, Md., March 19, 1905: Tulip-tree (262), pigweed (199), purslane (145), cowbane (124), elderberry (108), witch grass, etc. (98), oats (75), black mustard (74), common ragweed (51), sedges of genus *Carex* (44), buttonweed (39), pale persicaria (38), *Polygonum* spp. (35), lamb's quarters (31), spotted spurge (31), blackberry (28), great ragweed (21), green foxtail (18), yellow sorrel (18), beaked rush (17), yard grass (17), white ash, (12), mountain laurel (10), rice cut-grass (9), pokeweed (8), sedges beside *Carex* (8), black bindweed (7), Pennsylvania persicaria (6), aster (5), alternate-leaved dogwood (4), basswood (4), tubers of sedge (4), wild turnip (3), cockspur grass (3), broad-leaved dock (3), kinnikinnik (3), water oak (3), summer grape (3), green ash (2), touch-me-not (2), broad-leaved arrowhead (2), poison ivy (2), *Paspalum* sp. (2), water plantain (2), cocklebur (2), nightshade (2), corn cockle (1), bloodroot (1), scarlet sumac (1), spiderwort (1), beggar's ticks (1), mulberry (1), pine (1), spatterdock (1), sourgum (1).

W. L. McAtee.
Biological Survey,
Washington, D. C.

AN UNDESCRIBED ALTERNARIA AFFECTING THE APPLE.

An apparently undescribed species of *Alternaria* was found on a single specimen of apple a year ago while the writer was investigating apple rots at the Michigan Agricultural Experiment Station. On coming to this place the same fungus was found to be one of the most common causes of rot in apples in the state of Colorado. Professor W. Paddock, of the Colorado Experiment Station, had already done some work with this fungus.

The disease manifests itself by attacking the blossom end of the fruit, causing a decayed area of a very dark brown color. This area may remain quite small or it may gradually enlarge until the whole fruit is involved, after which the decayed specimens dry down to a shrivelled, hard mass. The fungus appears to affect different varieties to an unequal degree, some apple growers having reported that it is almost impossible to secure ripe fruit of certain kinds because of the attacks of this disease. In other cases it has been found associated with a blackened condition of the seed cavity in ripe fruit, the carpels being much discolored on the inner side. This condition may also be accompanied by a kind of core rot due to the invasion of the flesh around the carpels by the fungus.

Inoculation experiments are being carried on with a view to determine other possible hosts, as well as the characteristic effects of the fungus on the apple.

The fungus is apparently carried through the winter on portions of the flowers and fruit that were attacked by the fungus during the preceding season and which are still attached to the trees. Reports indicate that the fungus can be readily held in check by spraying with Bordeaux mixture.

B. O. Longyear.
Agricultural College Experiment Station,
Fort Collins, Colo.,
January 18, 1905.

ON THE USE IN SURGERY OF TENDONS OF THE ARDEIDÆ AND GRUIDÆ.

The subject of sutures and ligatures and their proper sterilization and use has long been an important subject in the realm of modern surgery. Various materials have from time to time been recommended, many to drop by the wayside, and we find even in the materials of the present day, namely, catgut, kangaroo tendon, silk, silkworm gut, horse hair and silver wire, great difference of opinion in the minds of surgeons as to their use.

The recent introduction* by Dr. Kieffer of an entirely new material will be of much interest to the surgeon, but it likewise will be of no less interest to the American ornithologist. Dr. Kieffer found after a series of experiments that the tendons of the Ardeidæ and Gruidæ made an excellent suture and ligature and, moreover, that they seemed to possess some advantages over the present materials, principally kangaroo tendon and catgut. The flexor and extensor tendons of the great blue heron (*Ardea herodias*) were first made use of, and later those of the sand hill crane (*Grus canadensis*) and whooping crane (*G. americana*). The tendons were readily made aseptic by the Claudius method of sterilizing catgut.

Regarding his experiments Dr. Kieffer says: "There is still room in the armamentarium of the surgeon for a reliable, slowly absorbable suture and ligature material. I have been recently investigating a material which I believe to be entirely new. Dr. Geo. P. Johnson, of Cheyenne, called my attention to the long and strong tendons in the legs of the bird commonly known throughout the United States as the blue crane. He had used this material with excellent results as a suture for the aponeurosis in a case of hernia, the suture giving no trouble and apparently being absorbed in time. I obtained from him a number of these tendons and immediately began a series of experiments to test their value. * * * As a result of these studies I have come to the conclusion that we have not only a valuable suture and ligature material, but one easily obtained in all parts of the world." It is to be wondered that the tendons of the larger grallatorial birds were not long ago thought of as suitable material for surgical purposes. Dr. Johnson is to be commended for his originality.

Thus the herons and cranes are given an economic value which unfortunately must further add to their destruction. Think of the thousands of these birds which would have to be killed annually should this material be adopted for ligature and suture purposes by even a small proportion of our American surgeons.

It is the least of my desire to criticize the author above referred to. His well-conducted experiments are commendable, but only to voice a word of warning to what at present might prove the extermination of the larger members of two great families of birds.

Unlike the Anseres (ducks, geese, swans) and members of the order Gallinæ, notably the bob-white (*Colinus virginianus*), the members of the Ardeidæ and Gruidæ are far from prolific breeders. Members of the latter-named families rarely lay over five eggs, while certain ducks lay as high as fifteen and the bob-white often more than twenty. Moreover, the latter two species often raise more than one brood in a season, and it is doubtful if the herons and cranes ever do. This will partially account for the survival of the game birds in spite of the inroads caused by gunners. Furthermore, herons build in colonies termed heronries, so that once the breeding place is located their capture is made easy. Thus the herons (*A. herodias*) of any one county of Michigan, for instance, might be exterminated by one hunter in the course of a season, should there be demand.

Unlike a great proportion of our American birds, little can be said of the economic value of members of the above-mentioned families, either as benefactors to agriculture as insect and weed-seed destroyers, or as articles of food.

A plea for the herons and cranes then can be made solely on sentimental grounds. It is their esthetic value, not as songsters, but their beauty, the grace which their presence adds to the landscape of the various portions of our continent. The history of a departing race is always a sad one and, judging from the thousands of dollars which are spent annually on our zoological gardens, we are inclined to believe that our people admire rather than desire to exterminate any of our native fauna. Truly the places occupied by our herons and cranes is a typical one, and as ornithologists we should aim to preserve rather than destroy.

Already some members of the tribe have

* 'A New Material for Sutures and Ligatures,' Charles F. Kieffer, M.D., *Jour. Am. Med. Assn.*, 1904, pp. 1519–1522.

been driven to the verge of extermination by the plume hunters. A strong public sentiment has been raised of late in favor of these species, not only in this country, but in various countries of Europe. Under the present conditions the organized bird protectors of this country, the Audubon societies, had looked for an increase in these species under our more recent laws regarding birds, but it is plain to see that should the tendons become popular with our surgeons for ligature and suture purposes the birds might have a still greater enemy. I do not consider the statement sweeping when I say that the extermination of some species would be only a matter of time.

However, as the author concludes: "Think of the comfort to the civil or military surgeon in isolated places of knowing that he can have a suture material at the end of his shot gun."

Alexander W. Blain, Jr.
Detroit College of Medicine.

Note on the Occurrence on Grain of Organisms Resembling the Bacillus Coli Communis.

It is a well-known fact that bacteria exhibiting the reactions of the *Bacillus coli communis* are widely distributed in nature, being found even on material least liable to pollution from any animal sources. Thus Prescott* has shown the occurrence of colon forms in wheat flour, corn meal, breakfast foods and various other food-stuffs only remotely liable to infection, as they are handled only on the large scale and in the open field or large mill. He also demonstrated their constant presence on certain grains—oats, barley, rye, wheat, buckwheat—taken directly from seed-warehouses and stores but slightly liable to contamination. Papasotiriu† has also demonstrated the presence of such forms on grains, showing them to be commonly present when small numbers of grains were studied. In his investigations cultures of ten kernels each of wheat, rye, barley, oats, peas, beans and corn were made in dextrose broth in triplicate, fourteen out of the twenty-one cultures giving positive results. The presence of these simulating forms in dough and articles manufactured from the hexoses has been studied carefully, especially by Lehmann and his pupils;* since, however, during the preparation such food-stuffs could become readily infected by the necessary handling, the results have less importance from the sanitary standpoint.

During the past months I have made some further investigations to determine whether bacterial forms simulating closely in their behavior the *B. coli communis* were present on grain which in all probability could not have become contaminated by direct contact with fæcal matter. In all investigations thus far reported some doubt may be cast on the integrity of the samples, or at least there is a possibility of contamination from handling or manufacture. In November, 1904, a field of rye was found in western Massachusetts which, owing to the scanty growth, had not been cut. The field is on light soil, on a level, open, sandy plain, and stands well back from a country road not heavily traveled. Inquiry showed that the field had not been fertilized and that no cattle had ranged through the grain during the fall. This stand of grain, therefore, may be taken as a typical open country growth free from contaminating influences. From this field heads of grain were picked with sterilized forceps and put into sterilized glass tubes. These heads were incubated separately in bouillon for twenty-four hours and then differentiated out through lactose-litmus-agar into pure culture, following the usual procedure. At the first test eight heads were thus treated and one gave abundant growth of an organism which repeatedly showed the characteristics of *B. coli communis*, and allied groups of organisms, solidifying and decolorizing litmus milk, giving a white expansive growth on agar, a heavy growth in bouillon, fermentation in dextrose broth with fifty to eighty per cent. gas production, fermentation in lactose broth with thirty to forty per cent. gas production, heavy indol reaction, heavy reduction of nitrate and a dirty yellowish growth on acid potato.

* Science, New Series, Vol. XV., No. 375, 1902, p. 303.

† *Archiv für Hygiene*, 1902, Vol. XLI., pp. 209–210.

* See papers in *Archiv für Hygiene*.

On December 10 a second lot of heads was secured in the same manner from the same field, and fifteen heads were treated as before; of these, four different heads yielded organisms exhibiting the above reactions characteristic of the colon group, the gas from the dextrose fermentation tubes in this series being more nearly that of the true colon type, varying from thirty to fifty per cent. and with a ratio of two to one.

On January 11 eleven more heads which had been kept in the glass tubes in the laboratory were subjected to the same procedure and one gave exactly the reactions of the *B. coli communis*. In all, therefore, at different times thirty-four heads from this field of rye were studied and from six of them organisms were isolated giving the reactions of the colon bacillus with the ordinary media. It will be recalled that these heads were taken at random over the whole field after they had stood through the storms of the fall, and snow of the early winter. Other heads of the rye gave indications of these acid forms, but did not exhibit the reactions typical of the colon group of organisms so decisively as those included above.

These results possess considerable interest from both the theoretical and practical standpoints. The question as to their origin first naturally arises. It is evident that either: (*a*) Colon forms must have been transported through the air as dust or carried by insects contaminated with animal excrement and thus deposited on the grain; or, (*b*) on these grain heads bacteria normally occur which in the several cultural processes exhibit most marked resemblances or absolutely correspond to the *B. coli communis*, or the colon group.

On the first assumption it is difficult to explain the persistence of these forms on grain, and especially on so large a proportion of the heads of grain distributed over an unfertilized field far removed from travel. If, however, this view be untenable, the other proposition must be accepted, viz., that forms of bacteria occur on natural grains closely resembling in their habit the distinctively fæcal forms, and which in our present methods of study can not be distinguished from them. It is extremely suggestive that these forms are so commonly present on most of the cereals thus far studied, being found even, as shown above, on standing grain before its harvesting, with the probabilities so against any contact contamination.

Further, the relation of these forms to the study of the pollution of natural waters is of the utmost importance. Whatever may be the source of the original seeding individual, the fact of their presence on the grain-heads suggests sources for the so-called colon bacilli in streams other than direct sewage pollution, and the presence of such 'colon forms' must be interpreted most carefully. Certainly the old hard and fast rule concerning the significance of the presence of *any* 'colon forms' as *prima facie* evidence of sewage pollution must needs be most discriminatingly applied.

It is unfortunate that the season of the year and locality where these experiments were carried out requires the postponement of further investigation until another season. Meanwhile the writer would value any suggestions or data bearing on this study, especially from the agricultural experiment stations, the publications from which may contain researches on these grain organisms which thus far have not fallen under his notice.

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CURRENT NOTES ON METEOROLOGY.

ALTITUDE AND ACCLIMATIZATION IN THE TROPICS.

IN a recent summary of the 'Report of the Census of the Philippines' (published April 8) which appears in the *National Geographic Magazine* for April, 1905, the following sentences are found: "That long exposure to the climate is enervating there can be no doubt, but the effect is easily avoided by periodical changes to a colder climate. This has been conclusively proven by the old Scotch, English and other white residents, who, after a residence of over forty years, broken by such removals, enjoy excellent health. Formerly it was necessary to take a sea voyage in order

to find relief, but with the completion of the electric railroad at Baguio, in the province of Benguet, this will no longer be needful, *as the climate at that altitude will afford the requisite change.*" (The italics are those of the compiler of these notes.) A study of the experience of European nations in the tropics leads to a much less optimistic view than that here set forth. Mountain stations, such as Baguio, are important, because they furnish some relief from the heat and humidity of the lowlands, and are above the zone of many tropical diseases, but they *do not solve the problem of acclimatization.* It is the monotony of the climatic conditions in the tropics which is one of the chief difficulties. The 'spur of the seasons,' which is so important an influence in giving the northern peoples their vigor and energy and 'push,' is lacking in the tropics. No mountain climate can supply this missing quality. A change to a colder latitude alone can do it.

THE NEW CAPITAL OF ERITREA.

CLIMATIC considerations have been the determining factor in bringing about the selection of a new capital for the Italian colony of Eritrea. The government offices have hitherto been at Massowa, on the Red Sea, where the climate is very trying. The present plan is to remove the seat of government to Asmara, on the high plateau of the hinterland, sixty miles in the interior, and 7,800 feet above the sea. Asmara is above the zone of the typical tropical diseases.

THE CLIMATE OF BALTIMORE.

PART 1 b, Special Publication, Vol. II., Maryland Weather Service, 1905, of a 'Report on the Climate and Weather of Baltimore and Vicinity,' by Dr. Oliver L. Fassig, has been issued. Part 1 a was recently mentioned in these notes. The present volume deals with humidity, precipitation, sunshine and cloudiness, winds and electrical phenomena, is a very thorough study, and contains abundant illustrations.

MONTHLY WEATHER REVIEW.

The Monthly Weather Review for December, 1904 (issued February 28, 1905), contains articles of general interest as follows: A review of Woeikof's new text-book of meteorology, by Dr. Stanislav Hanzlik (unfortunately this book is in Russian); a summary of the work done at the Aeronautical Observatory at Tegel, near Berlin, from October 1, 1901, to December 31, 1902; 'Evaporation Observations in the United States,' by H. H. Kimball (read before the Twelfth National Irrigation Congress, El Paso, November 16–18, 1904), accompanied by a chart showing lines of equal depth of evaporation in inches from a free water surface, computed from observations between July, 1887, and June, 1888; 'The Storm and Cold Wave of December 24 to 29, 1904,' by W. J. Bennett; 'Some Relations between Direction and Velocity of Movements and Pressure at the Center of Ellipsoidal Cyclones,' by Dr. Stanislav Hanzlik; 'Nitrogen in Rain Water,' 'The Vapor Pressure of Mercury,' 'Kite Work by the Blue Hill Observatory and the U. S. Weather Bureau.'

R. DEC. WARD.

MEMORIAL OF THE OHIO ACADEMY OF SCIENCE ON THE DEATH OF PROFESSOR A. A. WRIGHT.

THE executive committee of the Ohio Academy of Science has adopted the following memorial prepared at its request by Professor Lynds Jones in respect to the death of Professor A. A. Wright, of Oberlin, a member and a former president of the academy.

Albert Allen Wright died at his home in Oberlin on April 2, 1905, of acute peritonitis after an illness of scarcely twenty-four hours. Professor Wright was graduated from Oberlin College in 1865, received the degree of A.M. from Oberlin in 1868, the degree of Ph.B. from the School of Mines, Columbia College, 1875, was professor of mathematics and natural science at Berea College, Kentucky, 1870–73, and was called to the chair of geology and natural history of Oberlin College in 1874. With the change of title to professor of geology and zoology his service at Oberlin has been continuous since his first appointment.

Professor Wright was born in Oberlin in 1846. He served as a 100-day man during the closing days of the rebellion, and received his baccalaureate degree the following year at the age of nineteen. He began early to develop his natural taste

for science, and soon became recognized as a safe scientific thinker and investigator. He was one who never rushed to conclusions however enticing the facts discovered appeared, but took time to look into every possible avenue of approach to the subject, being satisfied only when his conclusions rested upon a foundation that could not be shaken. Consequently he was not a prolific writer. Indeed, he gave himself so unreservedly to his teaching and his students that research work was possible only during his brief vacations and at odd hours.

Professor Wright was a modest, retiring man, always shrinking from publicity, yet his service to the community and the state becomes conspicuous in his absence. Oberlin's unrivaled water and sewer systems are largely due to his hard study and keen insight. To him is almost wholly due the inception of the topographical survey of Ohio. In this he was at first defeated, but by untiring efforts and dogged determination saw the issue to a successful finish. He was also among the charter members of the Ohio State Academy of Science, which he served as president.

Probably among his most conspicuous contributions to science was his correction of Dr. Newberry's error in the true arrangement of the ventral armor of *Dinicthys*. While the publications over his own name were relatively few, his inspiration to others and his constant interest and unfailing kindness in spending himself for others who worked under him will continue long to be a potent factor in the advancement of science.

Professor Wright was a fellow of the American Association for the Advancement of Science, a fellow of the Geological Society of America, and member of the Ohio State Academy of Science.

HERBERT OSBORN, *President,*
L. B. WALTON, *Secretary.*

THE NEWFOUNDLAND WHALE FISHERIES.

THE returns of the Newfoundland Whale Fisheries for 1904 show that the eleven steamers employed took 1,270 whales, or an average of 116 each. In 1903 four steamers took 859 whales, or an average of 215 each. The Fisheries' 'Gazette' says that these returns make a very unfavorable showing and that comparison with those for 1903 is most depressing. That it is so is only what might have been expected. One can take out of a bucket only as much water as there is in it, and with the present rate at which whales are being killed, there is no reason to expect that the supply can at all keep up with the demand. Of course local causes may have been responsible for a part of the decrease, but this remains to be seen, and certainly a catch of 1,200 whales in the limited area around Newfoundland must be looked upon as enormous.

Those familiar with the history of fishing industries are quite aware that the fishermen never admit that their catch has any influence whatever upon the diminution in numbers of animal life; whales, seals and fishes are never exterminated, simply gone elsewhere, although that elsewhere is invariably where the wicked men cease from troubling and the weary animals are at rest.

The question is now being agitated as to what effect the diminution of whales will have upon other fisheries and in Norway the agitation carried on by the fishermen has progressed to such an extent that, right or wrong, the whale fishery in certain districts has been prohibited. That the diminution of whales may have an effect on fisheries is very probable, though it is extremely doubtful if the reasons assigned by the fishermen are the correct ones.

On the Newfoundland coast the whales feed entirely upon small isopods and it may be that the diminution in whales allows a wonderful increase of the *Euphausia,* who in turn feed upon the minute life on which the caplin and herrings are accustomed to feed. That the whales directly affect either herring or caplin or squid is more than doubtful, since none of these animals form any portion of the food of whales on the Newfoundland coast. Of the hundreds of whales examined none have contained anything save *Euphausia.* The smaller finback whales, such as *Batænoptera acutorostrata,* feed actively upon the schools of caplin, but this species is not common about the Newfoundland coast and certainly has no appreciable effect upon the fishes.

F. A. L.

BROOKLYN INSTITUTE MUSEUM.

CONFERENCE OF ANATOMISTS AT THE WISTAR INSTITUTE.

TEN of the leading American anatomists were invited by the Wistar Institute of Anatomy of Philadelphia to take part in a con-

ference held at this institute on Tuesday and Wednesday, April 11 and 12, to consider with the management of the Wistar Institute the question of increasing the usefulness of the Wistar Institute to American anatomists by establishing relationship with the individual anatomists of the country, with the Association of American Anatomists, with the *American Journal of Anatomy* and with similar institutes abroad; and also by establishing an Advisory Board of Anatomists of the Wistar Institute, with ten or more members, selected from the leading anatomists of the country.

The following anatomists were present at the conference:

Dr. Lewellys F. Barker, professor of anatomy, University of Chicago, Chicago, Ills.

Dr. Edwin G. Conklin, professor of zoology, University of Pennsylvania, Philadelphia, Pa.

Dr. Henry H. Donaldson, professor of neurology, University of Chicago, Chicago, Ills.

Mr. Simon H. Gage, professor of embryology, Cornell University, Ithaca, N. Y.

Dr. G. Carl Huber, professor of embryology and histology, University of Michigan, Ann Arbor, Mich.

Dr. George S. Huntington, professor of anatomy, Columbia University, New York City.

Dr. Franklin P. Mall, professor of anatomy, Johns Hopkins University, Baltimore, Md.

Dr. J. Playfair McMurrich, professor of anatomy, University of Michigan, Ann Arbor, Mich.

Dr. Charles S. Minot, professor of embryology, Harvard Medical School, Boston, Mass.

Dr. George S. Piersol, professor of anatomy, University of Pennsylvania, Philadelphia, Pa.

The first formal meeting was opened in the library of the Wistar Institute at 11 o'clock Tuesday morning. General Wistar, the donor of the institute, representing the board of managers, addressed the meeting and expressed his pleasure at having such a distinguished body of scientists present. He then spoke of the organization of the institute, its objects, its resources and its probable future.

Dr. M. J. Greenman, director of the institute, followed with a short address outlining the work which he thought might be accomplished by the conference. The objects and possibilities of the institute were stated. Reference was made to its independent organization, on account of which it is in a position to accomplish certain lines of work which could not be undertaken by other institutions.

The anatomists were called upon to consider what special lines of work the institute might undertake, to be of greatest service to American anatomy, to consider the relations of the institute to the American Association of Anatomists, to the American anatomists as individuals and to the *American Journal of Anatomy*. They were also requested to consider the possibility and advisability of establishing a central institute of neurology, utilizing the Wistar Institute as its working base, and acquiring relations with the committee appointed by the International Association of Academies for Brain Investigation.

Attention was called to the achievements possible by cooperation of individuals and other forces with an institution organized and endowed for research anatomy.

The organization of an advisory board of anatomists of the Wistar Institute was suggested as a possible means of accomplishing the most work for the greatest number.

The conference then organized and elected Dr. Charles S. Minot chairman and Dr. M. J. Greenman secretary.

The discussion which followed resulted in a unanimous opinion that the Wistar Institute of Anatomy offered most unique facilities for defining American anatomy, facilities which would be of advantage to all investigators in this branch of science. It was thought that research material might be collected and prepared there, especially neurological and embryological materials, thus saving much time to the interpreter; that original preparations which had been studied and therefore, of much greater value, should be deposited in the Wistar museum for future use of students who wished to review the work. The reproduction of models was suggested.

The importance of organized effort to collect and properly prepare the vast amount of anatomical material which usually goes to waste and the importance of its immediate use while fresh were emphasized. The establishment of agencies in various localities with skilled

preparators in charge for the collection of material was suggested. It was developed in the course of the discussion that the advanced grade of museum work which the institute strives to do and investigation are inseparable. It was considered that the pursuit of a well defined line of researches was necessary for the proper collection and preparation of materials. Neurology, embryology and comparative anatomy were discussed as the broad lines of work to be developed and it was thought that neurological researches should be the first to receive attention.

The first session was closed after having appointed a committee of three with instructions to formulate a series of propositions to be discussed at the morning meeting on April 12. The committee consisted of Chairman Minot, Dr. Donaldson and Dr. Mall.

The second session of the conference was called on Wednesday, April 12, at twelve o'clock; Chairman Minot presided. The committee presented its report, which is as follows:

"Notes taken at the meeting of the committee yesterday are presented in the following order: (1) The principal object of the institute to be research and under these headings: (*a*) a chief of investigation, (*b*) research assistants or assistantships and men who shall divide their services between the museum proper and research, (*c*) technical assistants. (2) Research and materials: (*a*) research shall be in the field of neurology, (*b*) comparative anatomy and embryology. (3) Relations: (*a*) committee recommends that the subvention to the *Journal of Anatomy* be granted, (*b*) committee be appointed to consider relations of the Wistar Institute to American anatomists, (*c*) the Wistar Institute to apply to the Association of American Anatomists for cooperation. (4) That an advisory board of ten be appointed for general purposes: (*a*) to form a subcommittee on neurology as well as other sub-committees that may be needed, (*b*) to establish relations with the committee of the International Association of Academies for Brain Investigation and with other committees for collective investigation, (*c*) the committee recommends that the board bear in mind that while the general trend of work above outlined is recommended there is no intention to advise limitation of the functions of the institute to it exclusively.

A brief discussion followed and the recommendations of the committee were unanimously adopted by the conference. Chairman Minot then presented these recommendations to the Wistar Institute as the finished work of the conference.

General Wistar thereupon expressed the approval of the Wistar Institute in every detail of the recommendations and asked the ten anatomists present if they would become members of a permanent advisory board of anatomists of the Wistar Institute and proceed to organize and appoint such committees as were recommended. General Wistar explained that he voiced the sentiment of the members of the board of managers present and he would assume authority for the creation of such a board and the appointment of its members and he had no doubt that the creation of the advisory board of anatomists and the personnel of its membership would be officially confirmed by the board of managers at its next meeting. The members of the conference consented and the advisory board was organized by electing Dr. Charles S. Minot as chairman and Dr. M. J. Greenman as permanent secretary.

The advisory board proceeded to appoint the following committees: on neurology and the establishment of relations with the International Association of Academies, Dr. L. F. Barker, Dr. H. H. Donaldson, Dr. F. P. Mall, Dr. J. P. McMurrich, Dr. C. S. Minot (this committee to elect its own chairman); on relations of the Wistar Institute to American Anatomists, Professor S. H. Gage, chairman, Dr. Geo. A. Piersol, Dr. G. Carl Huber; on comparative anatomy and embryology, Dr. Geo. S. Huntington, chairman, Dr. E. G. Conklin, Dr. F. P. Mall.

At the close of the meeting Dr. L. F. Barker was called upon by the conference to express its thanks to the Wistar Institute for the reception which was tendered the members of the conference and for the opportunity which

they had had of taking so active a part in a plan of such broad and liberal scope. Dr. Barker called attention to the unusual procedure of an endowed institution extending its facilities in such a liberal manner to the workers in the science and calling upon them to advise methods of development which would be mutually advantageous to both the institute and researcher.

The meeting of the advisory board then adjourned subject to the call of the officers of the meeting.

A meeting of the board of managers of the Wistar Institute was called on April 18 and the action of its representatives at the conference was officially confirmed.

THE CARNEGIE FOUNDATION.

THE announcement was made on April 27 that Mr. Andrew Carnegie had created a trust fund, to be known as 'The Carnegie Foundation,' to provide annuities for college professors in the United States, Canada and Newfoundland, who from old age or other physical disability are no longer in a position to render efficient service. The fund is vested in a board of trustees consisting in the main of presidents of institutions for higher education. It consists of $10,000,000 first mortgage 5 per cent. Steel Corporation bonds, the market value of which at present is $11,500,000, and will produce an income of $500,000 a year.

Mr. Carnegie's letter to the trustees is as follows:

NEW YORK, April 18, 1905.

Gentlemen: I have reached the conclusion that the least rewarded of all the professions is that of the teacher in our higher educational institutions. New York city, generously, and very wisely, provides retiring pensions for teachers in her public schools and also for her policemen. Very few indeed of our colleges are able to do so. The consequences are grievous. Able men hesitate to adopt teaching as a career, and many old professors whose places should be occupied by younger men can not be retired.

I have, therefore, transferred to you and your successors as trustees, $10,000,000 five per cent. first mortgage bonds of the United States Steel Corporation, the revenue from which is to provide retiring pensions for the teachers of universities, colleges and technical schools in our country, Canada and Newfoundland, under such conditions as you may adopt from time to time. Expert calculation shows that the revenue will be ample for the purpose.

The fund applies to the three classes of institutions named, without regard to race, sex, creed or color. We have, however, to recognize that state and colonial governments which have established, or mainly support, universities, colleges or schools, may prefer that their relations shall remain exclusively with the state. I can not, therefore, presume to include them.

There is another class which states do not aid, their constitutions in some cases even forbidding it, viz., sectarian institutions. Many of these, established long ago, were truly sectarian, but today are free to all men of all creeds or of none—such are not to be considered sectarian now. Only such as are under control of a sect or require trusteees (or a majority thereof), officers, faculty or students to belong to any specified sect, or which impose any theological test, are to be excluded.

Trustees shall hold office for five years and be eligible for reelection. The first trustees shall draw lots for one, two, three, four or five-year terms, so that one fifth shall retire each year. Each institution participating in the fund shall cast one vote for trustees.

The trustees are hereby given full powers to manage the trust in every respect; to fill vacancies of non ex-officio members; appoint executive committees; employ agents; change securities and, generally speaking, to do all things necessary in their judgment to insure the most beneficial administration of the funds.

By a two thirds vote they may from time to time apply the revenues in a different manner and for a different though similar purpose to that specified, should coming days bring such changes as render this necessary in their judgment to produce the best results possible for the teachers and for education.

No trustee shall incur any legal liability flowing from his trusteeship. All traveling and hotel expenses incurred by trustees in the performance of their duties shall be paid from the fund, the expenses of wife or daughter accompanying the trustees to the annual meeting included.

I hope this fund may do much for the cause of higher education and to remove a source of deep and constant anxiety to the poorest paid and yet one of the highest of all professions. Gratefully yours,

ANDREW CARNEGIE.

The trustees named by Mr. Carnegie, all of whom are said to have accepted, are as follows:

President A. T. Hadley, Yale University.

President Charles William Eliot, Harvard University.

President William R. Harper, University of Chicago.

President Nicholas Murray Butler, Columbia University.

President Jacob G. Schurman, Cornell University.

President Woodrow Wilson, Princeton University.

President L. Clarke Seelye, Smith College.

Provost Charles C. Harrison, University of Pennsylvania.

President Alexander C. Humphreys, Stevens Institute.

Chancellor S. B. McCormick, Western University of Pennsylvania.

President Edwin B. Craighead, Tulane University.

President H. C. King, Oberlin College.

President C. F. Thwing, Western Reserve University.

President Thomas McClelland, Knox College.

President Edwin H. Hughes, De Pauw University.

President H. McClelland Bell, Drake University.

President George H. Denny, Washington and Lee University.

Principal Peterson, McGill University.

President Samuel Plautz, Lawrence University.

President David S. Jordan, Leland Stanford Jr. University.

President W. H. Crawford, Allegheny College.

President Henry S. Pritchett, Massachusetts Institute of Technology.

F. A. Vanderlip, Esq., New York.

T. Morris Carnegie, Esq., New York.

R. A. Franks, Esq., Hoboken, N. J.

The trustees will take steps at once to organize a corporation. The first meeting of the board has been called for November 15.

SCIENTIFIC NOTES AND NEWS.

AT the meeting of the Geographical Society of Philadelphia on May 3, the Elisha Kent Kane medal was awarded to Professor William B. Scott, of Princeton University.

THE French government has conferred the rank of Officier d'Academie on Professor Angelo Heilprin, of Philadelphia, for his work in geography.

DR. J. H. VAN'T HOFF, professor of chemistry at the University of Berlin, has been elected a corresponding member of the Paris Academy of Sciences.

PROFESSOR HENRY M. HOWE, professor of metallurgy at Columbia University, has been elected corresponding member of the French Society for Encouragement of National Industry.

THE Lavoisier medal of the French Society for the Encouragement of National Industry has been awarded to M. Héroult for his work on electro-metallurgy.

DR. RALPH H. CURTISS, Carnegie assistant at the Lick Observatory, has been appointed assistant astronomer at the Allegheny Observatory, and will assume his new duties on about June 1.

PROFESSOR S. I. BAILEY, who is in charge of the Peruvian station of the Harvard College Observatory, has returned to Cambridge, where he will remain for the present. He is planning to observe the August total eclipse of the sun in Spain.

DR. FRIEDRICH KOHLRAUSCH, president of the 'Reichsanstalt,' retired on April 1.

DR. H. F. L. MATTHIESSEN, professor of physics at Rostock, having reached the age of seventy-five years, has been excused from holding further lectures.

SECRETARY WILLIAM H. TAFT will this year deliver the commencement address at Miami University.

PROFESSOR JEREMIAH W. JENKS, of Cornell University, lectured before the Philadelphia Geographical Society on May 3, his subject being 'Life in the Interior of China,'

THE first Adamson Lecture at Manchester University will be delivered by Professor Ward, of Cambridge, on June 2.

Torreya states that the American delegates, elected and, according to the rules of the International Botanical Congress, which meets at Vienna from June 11 to 18, entitled to vote in the deliberations upon the nomenclature question, are, so far as it has learned, the following: Members of the International Nomen-

clature Commission, N. L. Britton, E. L. Greene, B. L. Robinson, J. D. Smith; delegates from Section G, American Association for the Advancement of Science, C. R. Barnes, H. C. Cowles, C. L. Shear; from the Botanical Society of America, J. C. Arthur; from the Society for Plant Morphology and Physiology, W. G. Farlow; from U. S. Department of Agriculture, A. F. Woods; from the Torrey Botanical Club, N. L. Britton, L. M. Underwood; from the New York Academy of Sciences, L. M. Underwood; from the New York Botanical Garden, J. H. Barnhart; the American Academy of Arts and Sciences, the New England Botanical Club, the Boston Society of Natural History and the Vermont Botanical Club will be represented by B. L. Robinson.

Dr. Henry H. Goodell, president of the Massachusetts Agricultural College, died on April 23, at the age of sixty-six years.

We regret also to record the deaths of Professor Bruno Kerl, formerly professor of metallurgy in the Berlin Academy of Mines, at the age of eighty years, and of Dr. Leopold Maggi, professor of comparative anatomy at Pavia, who died on March 1.

There will be a civil service examination on May 17 to fill the position of bacteriological chemist in the Bureau of Chemistry, Department of Agriculture, at a salary of $2,000 a year. The position is open to those who have the degree of doctor of philosophy or who have an equivalent training.

The Cardiff Corporation has offered a site, worth £20,000, for the erection of a national museum for Wales, and has voted £2,000 for the maintenance of the museum and £1,000 a year towards the expenses of a library. The Mackintosh of Mackintosh has promised £2,000 towards the museum and library, provided Cardiff is selected as the locality. Mr. John Cory has also promised £2,000 on like terms.

The new sixty-inch reflecting telescope made in England in 1888 by the late A. A. Common and purchased this year by Harvard University, is being set up at the astronomical observatory. A two-story building, fifteen by twenty-seven feet, has been erected to inclose it.

We learn from *The Observatory* that Starfield, Crowborough Beacon, the house and observatory of the late Dr. Roberts, was put up to auction on March 17, but was not sold. The highest bid was £5,000, which was evidently below the reserve.

The International Bureau of Labor at Basel offers the following prizes for the best treatises on the following subjects: Prevention of danger in exploiting and preparing lead ores, $1,200; obviating danger from working the metal in lead works, $2,400; two best treatises on prevention of danger in the chemical use of lead in lead works, accumulator factories, etc., $600 and $350; nine prizes, ranging from $178 to $357, on obviating or removing the danger from lead poisoning in the trades where lead is used, such as painting, type casting, printing, etc.

It is announced that the prize founded in honor of the celebrated Geneva family of botanists, De Candolle, is now offered by the physics and natural history society, of Geneva, Switzerland. The subject will always be a description of a species or family of plants. Members of the society are not permitted to compete, and limitations as to nationality are not made. The essays may be written in Latin, German, French, English or Italian, and must be transmitted to the president of the society before January 16, 1906.

The second annual field symposium of botanists will be held during the week beginning July 3, 1905, at Ohio Pyle, a point on the Baltimore and Ohio Railroad in Fayette County, southwestern Pennsylvania, where arrangements have been made for the accommodation of the party. Information concerning details of the trip and the proposed program may be obtained from either Mr. Joseph Crawford, 2824 Franklin Avenue, Philadelphia, representing the Philadelphia Botanical Club, from Dr. J. A. Shafer, New York Botanical Garden, Bronx Park, New York City, representing the Torrey Botanical Club, or from Dr. J. N. Rose, U. S. National Museum, Washington, D. C., representing the Washing-

ton Botanical Club. The pleasant and profitable experiences gained by those who attended the first of these meetings, held at McCall's Ferry, Pennsylvania, in July of 1904, give reason to believe that there will be a large attendance at Ohio Pyle. A detailed report of the proceedings at McCall's Ferry will be found in the February issue of the *Plant World*.

A CONFERENCE of scientific scholars was held at Colorado College, Colorado Springs, on April 28 and 29, leading universities and colleges sending representatives. A number of valuable papers upon subjects bearing on the scientific problems of the Rocky Mountain country were promised.

THE annual conference of the British Child-Study Association will be held at Derby on May 11–13, under the presidency of Professor Muirhead, of Birmingham University.

THE Boston Scientific Society celebrated its twenty-ninth anniversary at a dinner on April 25. Dr. H. Helm Clayton, of the Blue Hill Observatory, acted as toastmaster. Speeches were made by Professor A. E. Dolbear, of Tufts College, Professor George H. Barton, of the Teachers School of Science, Mr. John Ritchie, Jr., and others.

THE annual convention of the American Institute of Electrical Engineers will be held at Asheville, N. C., from June 19 to 23.

THE United States consul at Frankfort reports that Professor Fluegge, president of the hygienic institute at Breslau, has sent the following circular to the owners and managers of dwellings in one of the districts of that city: "The common council has resolved to fight in a systematic manner the mosquito plague, which prevails every year, and the plan for the purpose has been worked out at this institute. It is necessary in the first place to destroy, before warm weather sets in, the mosquitoes which pass the winter in the cellars and basements of houses. These cellar and basement mosquitoes will be destroyed by municipal experts without inconvenience to the people and without injury to property. In order to make it possible to carry out the plan successfully we respectfully request the admittance of the disinfectors to the cellars of houses and permission for them to take the steps necessary to kill the mosquitoes. The disinfectors will have identification cards." According to the *Silesian Gazette*, the plan for fighting the mosquito plague is to be worked out in two directions. The hibernating mosquitoes, which are almost always found in the cellars of houses adjoining unoccupied territory, parks, gardens, etc., must be killed. These are found in somewhat damp cellars, facing north, and are recognizable with difficulty by those not experts, but cover the ceilings by thousands. In the spring they leave and lay their eggs in water, the larvæ producing mosquitoes within three to four weeks. A supplemental effort will be made to destroy the larvæ, which are found principally in stagnant, shallow pools. These must be either filled in or treated with malachite green or other larvæ-destroying substances. For the present this process will only be employed in that part of the city which suffers most from the mosquito plague. If it proves successful it will be extended next year over the whole city. Fighting mosquitoes will be carried on in a systematic manner on a scientific basis. Summer resorts and watering places, especially, should imitate the example set by Breslau.

WE learn from *The Athenæum* that Dr. Theodor Koch, who for the last two years has been traveling in the interior of Brazil, sends a very interesting account of his travels. He followed the course of the Rio Uaupès beyond the last rapids, and spent a considerable time with the Kobéua Indians, whose religious mask dances are so curious. He made a thorough study of their language, and in their company visited the Rio Cuduiary. The whole district watered by these rivers is of great interest, as it is inhabited by a number of tribes who speak distinct dialects and retain all their ancient habits and customs, as the nature of the river renders their dwelling-place almost inaccessible. Dr. Koch has been successful in obtaining photographs, and has a fine collection of weapons, masks, costumes and domestic utensils.

According to the *British Medical Journal* in 1861 the total number of medical practitioners in Italy was 18,947, the proportion to population being 8.8 per 10,000. In 1881 it was 18,950, or 6.6 per 10,000. In 1901 it was 22,168, or 6.8 per 10,000. The distribution of practitioners is somewhat unequal, the proportion being higher in the south (7.7 per 10,000) than in the north (6.1 per 10,000). In the province of Udine the proportion is lower than anywhere else in Italy, there being only one practitioner to 2,831 inhabitants; in that of Naples it is highest, there being two doctors to 732 inhabitants.

UNIVERSITY AND EDUCATIONAL NEWS.

Dr. Brown Ayres on April 25 was inaugurated as president of the University of Tennessee. Senator James B. Frazier presided. The welcome to Dr. Ayres for the colleges of the east was delivered by Dr. J. S. Ames, professor of physics at the Johns Hopkins University; on behalf of the colleges of the west, by President George E. McLean, of the University of Iowa, and on behalf of the southern colleges, by Chancellor R. B. Fulton, of the University of Mississippi. Following Dr. Ayres's inaugural address Dr. Charles Dabney, president of the University of Cincinnati, who was the immediate predecessor of Dr. Ayres at Tennessee, delivered an address. Dr. Ayres came to the University of Tennessee from Tulane University, where he was professor of physics. At the inaugural exercises a gift was announced from Mr. Andrew Carnegie of $40,000 for a library building, conditioned upon the securing an equal amount as an endowment; and a gift of $7,600 from Mr. John L. Rhea, the income to be used in the interests of the engineering departments.

After a long contest in the courts the will of Henry C. Peabody, inventor of the rifle bearing his name, has been affirmed. This was partly the result of a compromise, by which an additional $20,000 goes to the heirs. About $350,000 will be used for the establishment of an industrial school for girls at Norwood, Mass.

The legislature of Tennessee, in passing a bill appropriating $25,000 a year for ten years for the Peabody Normal College, at Nashville, has assured the reception by that institution of $1,000,000 from the division of the Peabody Fund.

President Schurman, of Cornell University, has received $1,000 from Mr. and Mrs. Gerrit S. Miller, of Peterboro, N. Y., for the foundation of a free book fund in memory of William C. Seidell, who worked his way through the university and graduated in 1904.

University College, Sheffield, is to be given a charter as the University of Sheffield. The city will contribute about $40,000 annually to its support. The present college buildings, which are not united on a single site, are to be vacated shortly for handsome new buildings on a site adjoining one of the public parks of Sheffield, now within a few months of completion.

A summer school will be held at the University of Colorado, Boulder, from June 17 to July 26. Courses in science are as follows: chemistry, physics, geology, psychology and botany. The work will be given by the regular professors of the university.

Professor R. B. C. Johnson (philosophy) and C. H. McIlwain (history) have resigned from Miami University to accept preceptorships at Princeton University.

At the recent annual meeting of the regents of the University of Nebraska Dr. F. D. Heald, adjunct professor of plant physiology, was elected botanist of the Agricultural Experiment Station, and associate professor of botany in the University School of Agriculture. Appropriations were made for equipping his laboratories in the new Agricultural Hall on the station farm. At the same meeting Dr. F. E. Clements, assistant professor of botany, was promoted to be associate professor of plant physiology.

Dr. Alfred Hettner, associate professor of geography at Heidelberg, has declined a call to a professorship at Breslau.

Dr. Paul Grube has resigned the chair of physics in the University of Giessen.